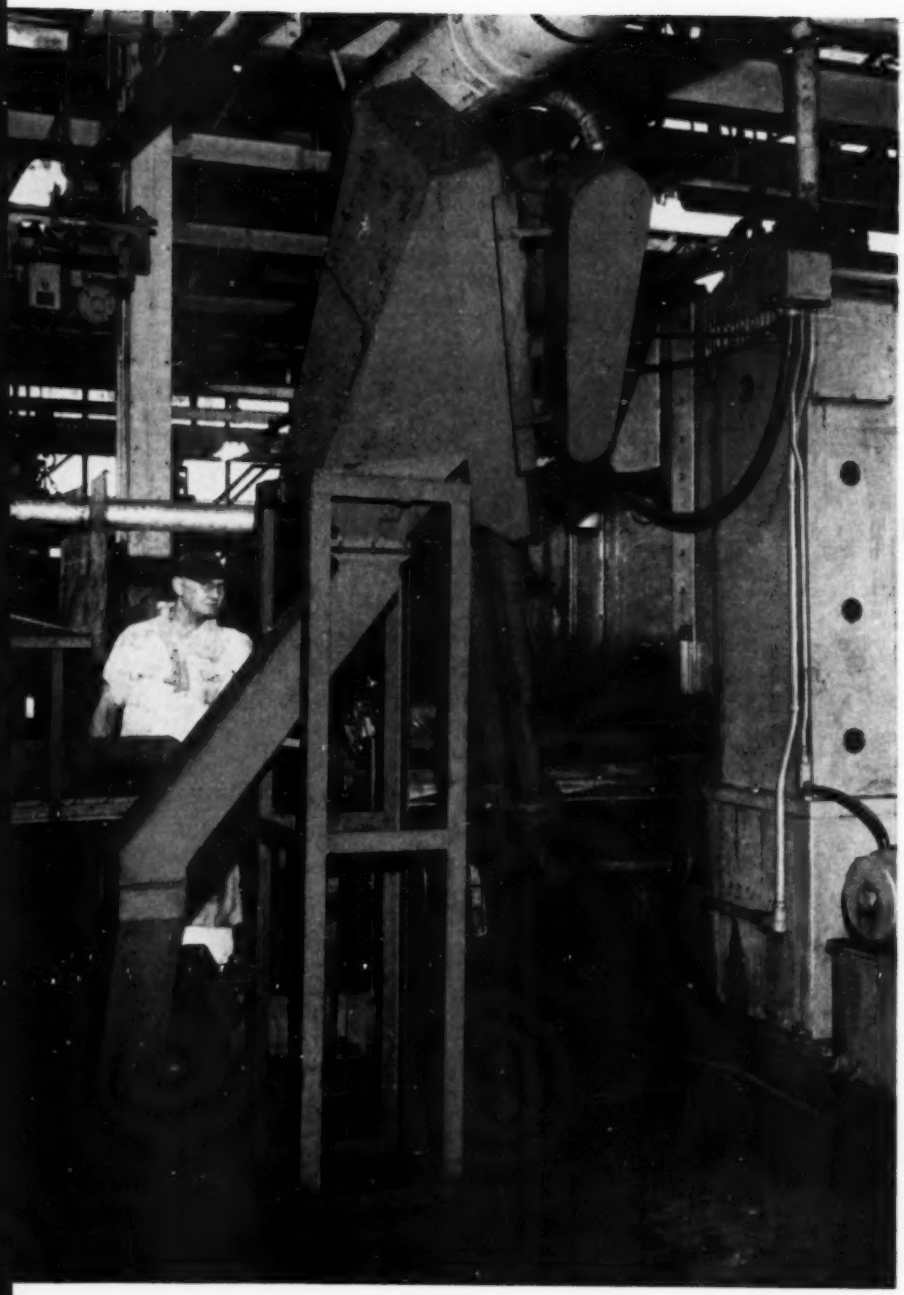
Industry and Power



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for engineers and engineering executives responsible for

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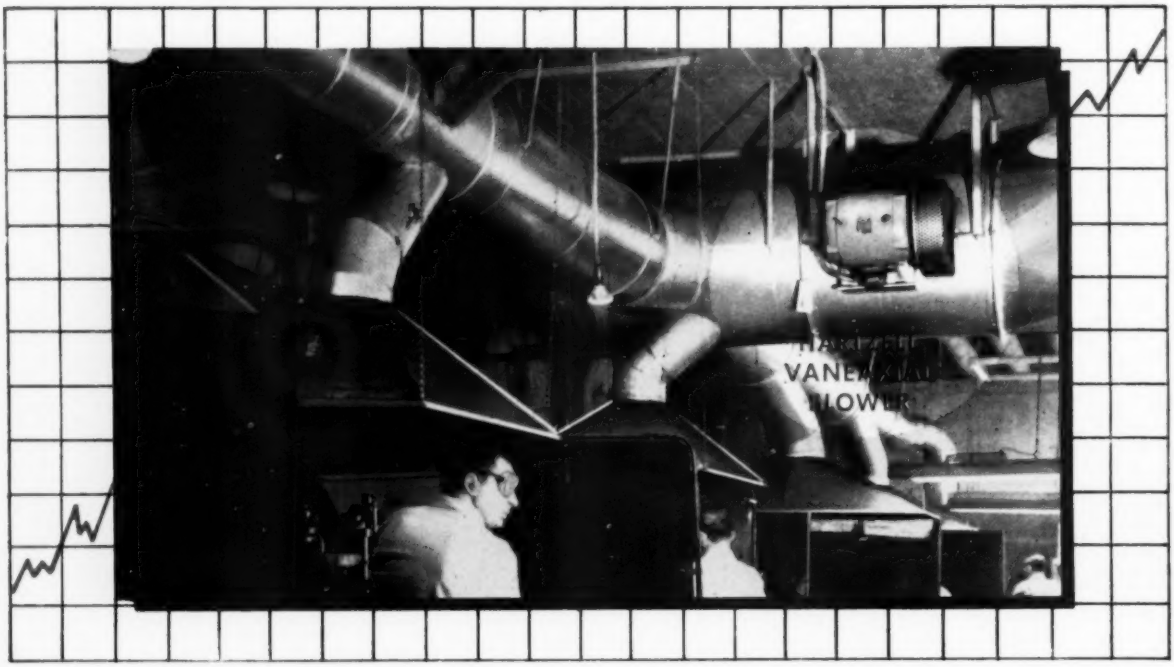
Hartzell Air-Moving Equipment
Can Brighten Your Production Picture, Too



Built-in Power To Move Air Against Pressure

If you need a powerful blast of air against pressures as high as 7½" water gauge, you need to know about Hartzell vaneaxial blowers. Belt-drive models from 12" to 54", direct-drive from 18" to 42".

With the special Hartzell High Temperature Vaneaxial Blower you can move air at elevated temperatures, or air containing acids, alkalies or grit, without fear of premature failure of belts and bearings. Write for details.

Production in a large Jersey City plant was hampered by accumulations of heat, smoke and fumes over 29 die-casting machines. Three canopy-exhaust systems, powered by Hartzell vaneaxial blowers, now remove the irritating elements before they can cause trouble. As soon as working conditions were improved, production showed a substantial increase.

Hartzell specialization in *industrial* air-moving problems paid off for this company. It can help you, too.

Your nearby Hartzell field representative puts the engineering "know-how" of the whole organization right in your back yard. If inadequate ventilation is clouding your production picture, give him a call today. Hartzell's complete line includes the fan or blower which will solve your problem.

Write today for your copies of Bulletins describing Hartzell propeller fans and vaneaxial blowers. They're rich with valuable engineering data.

HARTZELL *propeller fan co.*

Div. of Castle Hills Corp.

Name _____

Company _____

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Dept. B

PIQUA, OHIO

PROPELLER-TYPE FANS • BLOWERS
ROOF VENTILATORS • UNIT HEATERS

ENGINEERING OFFICES IN PRINCIPAL CITIES

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6 YEARS'

Trouble-Free Service

GOODYEAR INDUSTRIAL PRODUCTS
GTM-Specified
STEEL CABLE V-BELT DRIVE FOR SWING GENERATOR ON DRAGLINE
68.5"
DRIVEN PULLEY 58" O.D. FLAT PULLEY
MOTOR PULLEY 23.6" PD 11 GROOVE-QD SHEAVE ON 87.5 KW GENERATOR (150-175 H.P.-725 R.P.M.)

Heavy dust and severe overloading conditions caused rapid failure, frequent replacement and costly shutdowns on the swing generator on this big dragline.

Drive was redesigned by the G.T.M.—Goodyear Technical Man—as a V- to flat-pulley drive, and fitted with matched Steel Cable V-Belts. These rugged belts, muscled with endless, airplane type steel cables, ran for six years with no trouble of any kind. And they had plenty of drive left when accidental damage required their replacement.

Goodyear, Industrial Products Division
Akron 16, Ohio

YOUR GOODYEAR DISTRIBUTOR *can quickly supply you with Hose (air, water, steam, oil, special), Belting (V-belts, transmission, conveyor, elevator), and other industrial rubber products. Look for him in the yellow pages of your telephone directory under "Rubber Products" or "Rubber Goods."*

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We think you'll like "THE GREATEST STORY EVER TOLD"—every Sunday—ABC Radio Network—THE GOODYEAR TELEVISION PLAYHOUSE—every other Sunday—NBC TV Network.

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STANDARD HD
TRADE MARK
OIL

Running up record ring life with . . .

● In 1947, operators of a midwest municipal power plant put a new 1060-hp diesel unit into service, using STANDARD HD Oil for lubrication.

After 19,000 hours' operation, the unit was shut down for inspection. The engine was entirely free from deposits and showed minimum wear. Piston rings were in excellent condition and were replaced in the engine for further service. This unit is still going strong with a total of 23,000 hours of trouble-free operation on its original piston rings.

Installed in 1950, a 1755-hp, supercharged diesel engine in this plant is running up another record for low maintenance with STANDARD HD. After more than 9,000 hours' operation, this unit was inspected and found unusually clean. Rings were free, and it was not necessary to remove them for cleaning purposes.

The outstanding performance of STANDARD HD Oil in all types of diesel-generating installations provides the evidence of the benefits it can bring in your diesel units. The Standard Oil lubrication specialist serving your immediate area of the Midwest will be glad to give you this evidence, using plants with which you may be familiar. Phone your local Standard Oil office. Or write: Standard Oil Co., 910 S. Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY

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STANDARD (Indiana)

Published by
Industry and Power Publications

Industry and Power

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GET LOWER OPERATING COSTS
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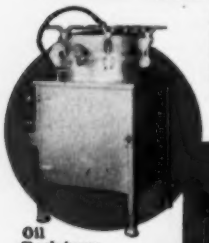
● *THERE'S A* **HILCO** *FOR EVERY LUBRICATION AND FUEL OIL FILTERING PROBLEM*



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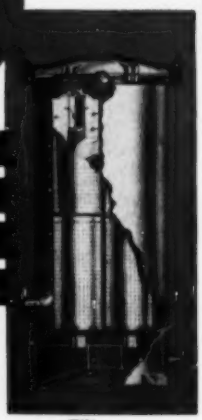

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ELMIRA, N. Y.

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980 Bay St., Toronto, 3464 Park Ave., Montreal

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acorns

. . . recently announced . . . worth watching

Sintering Techniques

● Advanced techniques in sintering metals promise decided improvements in high-temperature, high-strength properties of relatively pure metals with considerable savings in alloying materials. Some experts believe that the future lies in sintering metals and ceramic materials. The metals give workability and shock resistance; the ceramics provide high-temperature strength. Powders of metal and ceramics are combined in the proposed processes.

Supersonic Measuring

● Work has been reported on progress made in applying supersonic techniques to the measurement of thickness through surfaces which are curved. Particular application has been made in gaging the thickness of diesel cylinder walls.

Coating Stator Blades

● Turbine stator blades have been coated in experiments with dry-pressed aluminum titanate-aluminum silicate for thermal shock tests. The aluminum titanate stator blades were successfully bonded with clay or topaz. Compositions containing from 5 to 40 percent aluminum silicates as bonding materials have been used.

Study Fuel Sprays

● Investigations into the atomizing of fuels are being conducted by a group using three methods of study. The first is a photographic technique which does not require capturing a sample; this approach was developed to measure the size and velocity distribution of the drops in any spray. A second study uses a rapid spray analyzer to evaluate nozzle performance and to match sets of nozzles. The third is a combustion program to correlate spray characteristics of nozzles and combustion performance.

Casting Developments

● Sealant materials and impregnation techniques are on the way which will permit making faulty castings pressure tight and usable. Stress relief investigations by another group show that stress relief in gray iron castings is most rapid during the first hour at temperature, that relief is slow under 1000 F but increases with temperature, and that initial stress and alloying greatly affect relief attained by heat treatment.

Optimum Welding Conditions

● Study is reported on electrode force, timing cycles, wheel speeds, welding current, and surface treatment as related to seam welding of Monel sheet. For 0.031-inch Monel, optimum conditions were found to be 2 cycles "on" and 4 cycles "off," 1600-lb minimum electrode pressure, and a wheel speed of 9 welds per minute.

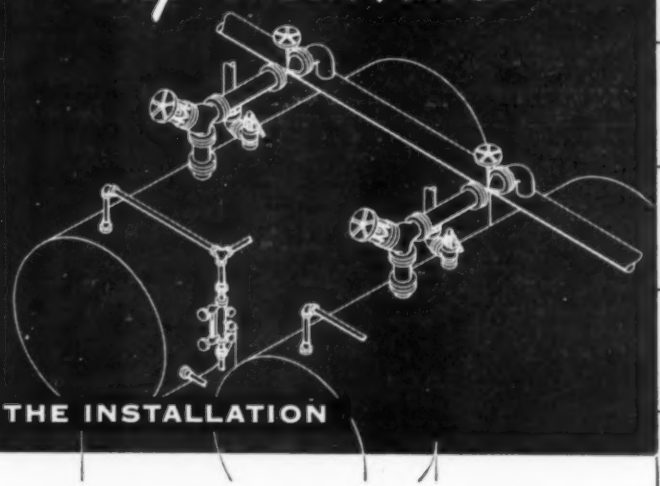
Lifetime Storage Batteries

● Nickel-cadmium storage batteries have been imported from France which are expected to last far longer than conventional lead-acid batteries. Although the new battery costs about three times more than a conventional battery, there are many offsetting advantages. Ampere-hour capacity of the new unit is about 90 percent higher. The cells are hermetically sealed and require no filling with water. There is no hydrogen gas to contend with during recharging and the electrolyte is a non-corrosive alkaline solution. First tests of the new battery will be in aircraft where it is expected the batteries will last the lifetime of the aircraft without recharging. If this proves true, designers will be able to place the batteries anywhere in the plane where room exists since there will be no need for access to recharge or fill the cells.

Radioactive Wastes Disposal

● Looking to the days ahead when disposal of radioactive waste materials will be a more common problem than it perhaps is now, data have been released on studies made of institutional incinerators handling such wastes. Techniques have been considered for measuring the amounts of radioactivity in stack walls, ash, stack gases, and in the atmosphere during and after incineration. With some isotopes, it was found that dangerous concentrations remain in the ash whereas other isotopes produce waste gases bearing sufficient radioactivity to cause undesirable atmospheric conditions.

30 Years of Safety and Efficiency with these High Quality Stop-Check Valves



THE INSTALLATION

At the Eureka Redwood Lumber Company, Eureka, Calif., featuring eight 5-in. Crane stop-check valves on boiler lines to main steam header.

VALVE SERVICE RATINGS

SUITABILITY:	On the job for 30 years
FEATURES:	Only one moving part
MAINTENANCE COST:	One seat regrinding only
SERVICE LIFE:	Installed 1923 – still O.K.
OPERATING RESULTS:	Efficient performance – safe operation
AVAILABILITY:	Crane Catalog item – No. 30E

THE CASE HISTORY

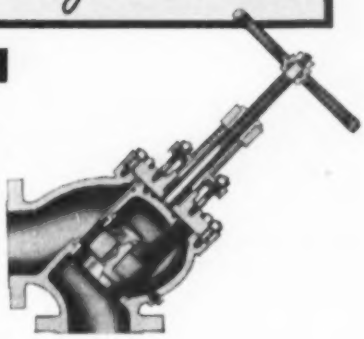
Thirty years' continuous service is by no means the record for Crane 250-Pound stop-check valves. But when 6 such valves, all installed in 1923, are still on the job, and still giving complete satisfaction, surely that's worthy of note. So well did these Crane No. 30E stop-checks perform right from the start, that 11 years later, in 1934, 2 more were put on boilers installed that year.

Here are 8 valves with a collective service record of more than 220 years. And in all that time, the only maintenance required was regrinding the seat of one valve.

It takes a lot of quality to deliver such valve performance with so little upkeep. That's why today, in face of rising maintenance cost, Crane quality is more than ever the first choice of the thrifty valve buyer.

THE VALVE

Simplicity and dependability are still the chief characteristics of Crane 250-Pound stop-check valves. They have just one moving part—the piston-type disc that operates in a removable liner, without chatter, vibration, or rapid wear. You'll have a safer power plant with these valves on your boilers, and they'll permit steam flow to the main header at minimum pressure drop. See your Crane Catalog or Crane Representative for complete information.



THE BETTER QUALITY...BIGGER VALUE LINE...IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

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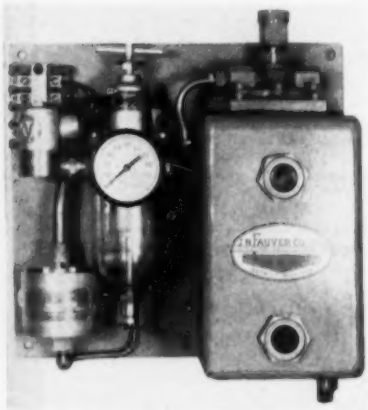
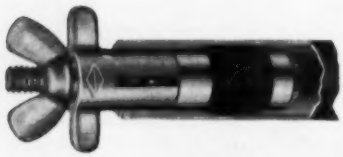
new equipment

. . . new developments



Oiling system operates on compressed air

K10 Operating solely on compressed air, the Oil-Air lubrication system, manufactured by J. N. Fauver Co., Inc., applies a constant and uniform oil film to groups of bearings. Oil is atomized into microscopic particles which are carried in an air stream and distributed through tubing to the bearings. The system consists of solenoid valves, filter, water separator, regulating valve lubricator, reservoir, pressure switch, and low level indicator.

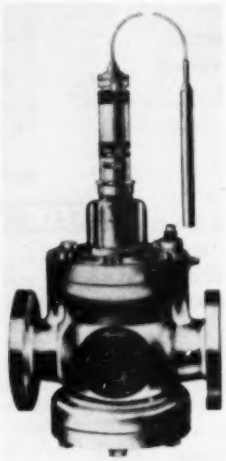


Tubing plug developed for trouble shooting

K11 New test plugs, for use where it is desirable to shut off the end of a tube temporarily, have been announced by The Imperial Brass Mfg. Co. Especially convenient for use in instrumentation, radiant heat, refrigeration, LP gas, and similar installations, these plugs make it possible to test tubing installations before they are put into service or when trouble shooting for leaks. They will hold pressures to 100 psi, and can be used on all liquid or gas lines except those carrying materials which deteriorate synthetic rubber. Sizes are ¼, ⅜, ½, ⅝, and ¾ in. OD. Literature is available.

Pilot relay unit is added to flow meter

K12 Lightweight Differential Converter units incorporating a pilot relay transmitter that reduces air consumption to the minimum have been developed by the Industrial Div. of Minneapolis-Honeywell Regulator Co. They convert the differential pressure of flow into air pressure, transmitting this through tubing to indicating, recording, or controlling instruments. Using only one-sixth as much air as the conventional nozzle-pressure transmitters, they are virtually unaffected by variations in the air supply. Because mercury is not used, maintenance is said to be simplified and the problem of contamination eliminated. The compact units, which can be mounted on the pipeline close to pressure taps, have a high temperature rating—meter bodies can stand process fluid temperatures up to 350 F and the transmitter, up to 225 F. Literature is available.



Temperature regulators have self cleaning steam strainers

K13 Compact, self contained pilot operated temperature regulators have been developed by Farris Stacon Corp. to incorporate design simplicity and the advantages of the liquid expansion principle in larger size valves. Built-in self cleaning steam strainers protect vital parts of both the pilot and main valves and eliminate the need for a separate strainer in the piping system. A small compact thermal system, liquid filled, is easily replaced in the field without removing the regulator from the line. Sizes range from 2 to 4 in. and the regulator is useful for controlling temperatures from 25 to 275 F through a 50 deg range. Maximum pressure limit is 125 psig. A bulletin is available.

Condensate return pump occupies small space

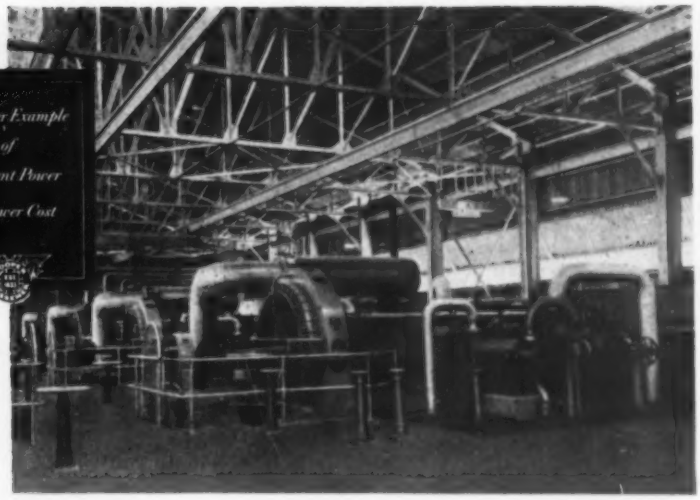
K14 Seal-less construction eliminates all packing glands, rotary seals, and O-rings in a condensate return pump manufactured by Sterling, Inc. An overflow connection takes the place of the usual vent. Known as the Lowboy, the unit occupies only 1½ sq ft of floor space and has a return inlet less than 7 in. from the floor. The ¼-hp motor, pump, and switch assembly can be lifted out for inspection or service without special tools. Capacity is 4½ gpm discharge, operating up to 20 lb discharge pressure without adjustment.

Cobalt 60 safely handled with portable shield

K15 Portable, directional, exposure shields for the safe handling of strong sources of Cobalt 60 have been designed by Technical Operations Inc. No specially constructed room is required since the unit functions to shield all radiation except the beam directed at the area to be exposed.

(Continued on page 12)

NOTE—Each new product item has a key number for your convenience in asking for additional, detailed information. Circle this number on Reply Card between pages 34 & 35.



Cooper-Bessemer

MODERN DESIGN...

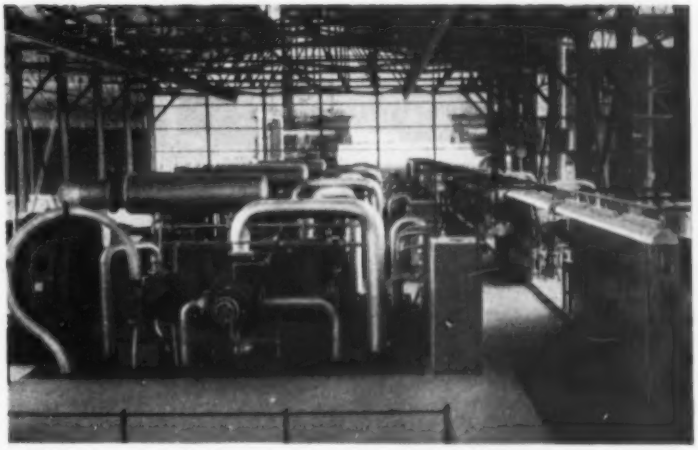
for compressors at Sindri . . . at Suez . . . everywhere!

● Shown opposite are Cooper-Bessemer motor-driven compressors in two of the world's newest and largest synthetic ammonia plants.

The top view shows part of the 22,000 Cooper-Bessemer M-Line compressor horsepower installed in the ammonia synthesis plant of the Sindri Fertilizer Factory, Bihar Province, India. Here, ammonium sulphate can be produced at a rate of 1,000 tons a day — 350,000 tons a year!

Similarly the other photo shows a line-up of Cooper-Bessemer compressors in the large Suez plant of the Societe Egyptienne D'Engrais et D'Industries (S.A.E.), Egypt. Here, calcium nitrate fertilizer is produced at a rate of 200,000 tons yearly.

In both plants, these modern Cooper-Bessemer units handle the entire compressing job and comprise the heart of production operations. For, with Cooper-Bessemers, you can be sure of year-in, year-out performance at the lowest operating cost.



Cooper-Bessemer M-Line motor-driven compressor in the synthesis section of the Sindri Fertilizer Factory, India. Here eight 2,750 hp 7-cylinder units compress gas through six stages to a pressure of 5,500 psi. The huge Sindri plant was engineered by the Chemical Construction Corp., New York, and built under the direction and supervision of the Power-Gas Corp., Ltd., England.

Here, in the Suez plant of the Societe Egyptienne D'Engrais et D'Industries (S.A.E.), these four 2,750 hp JM-5 motor-driven units compress 25,344 mcf of gas daily from atmospheric to 5,200 psi for initial calcium nitrate production of 200,000 tons yearly. This plant, engineered by the Chemical Construction Corp., utilizes waste gases from nearby oil refineries.

The Cooper-Bessemer Corporation

MOUNT VERNON, OHIO — GROVE CITY, PENNA.

New York Washington, D. C. Bradford, Pa. San Francisco Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle Tulsa Shreveport St. Louis Los Angeles Chicago Cooper-Bessemer of Canada, Ltd., Halifax, Nova Scotia Gloucester, Mass. New Orleans, La.

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The barrel that's rolling for industry...NEW H
H
HYATT BEARINGS DIVISION, GENERAL MOTORS CORPORATION

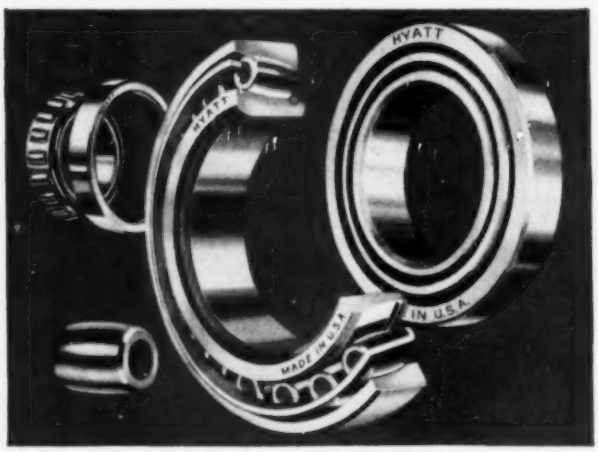
YATT BARREL BEARING

now available in volume!

Hyatt is rolling out the barrels! . . . and a familiar shape is giving a big lift to modern industry! A new Barrel Bearing —pioneered and perfected by Hyatt—is available in volume for the first time! There's no other bearing quite like it—and it's ready for a starring role in industrial production!

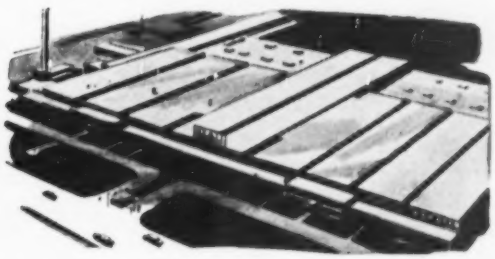
The Barrel name comes from the barrel shape of the rollers . . . but its superiority in bearing applications comes from *dual-purpose design* and *self-aligning ability!* This unique bearing takes load from any direction . . . and operates at full load-carrying capacity under conditions of misalignment! And in addition, the barrel shape of the rollers combines the low rolling friction of a ball with the high load capacity of a cylindrical roller—so that the Barrel Bearing is ideal for a wide range of applications.

Expensive? *Not at all!* Advanced manufacturing processes —plus the facilities of one of the newest and finest bearing plants in the world—make the initial cost far lower than you would expect! . . . For full information on this newest solution to the friction problem, write to the address below.



Self-aligning action makes the Barrel Bearing ideal for tractors and farm implements. Over many years, its durable, dependable performance has been established in a wide range of these applications.

In trucks and construction equipment, too, Hyatt's Barrel Bearing operates with full efficiency under conditions of heavy, multiple-direction loading. Unique roller and race design distributes the load over large areas of contact.



Hyatt's new plant, in Clark Township, N. J., is among the most modern in the world. New equipment makes possible advanced manufacturing processes, and research facilities are the finest in the bearing industry.

YATT ROLLER BEARINGS

HARRISON, NEW JERSEY

Circle 506 on Reply Card for more data

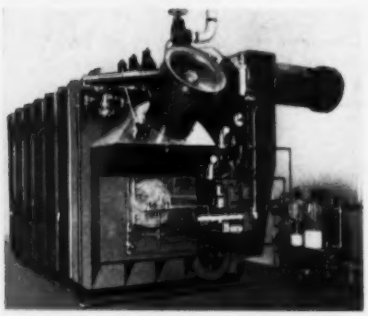
new equipment

(Continued from page 8)

The radio active material is moved into or out of position, 12 to 56 in. from the floor, by one control and the beam may be varied from straight up to 45 deg below horizontal. Known as the DES, the unit serves as a storage container when the cobalt is not in use.

Unit records variables at different points

K16 Three variables such as liquid flow, liquid level, and displacement at 20 different points can be recorded in sequence with the unit designed by Hastings Instrument Co. The instrument can be set to different combinations of manual or automatic control and may be adopted to record as many as 60 variables. It is now being used with pick-up probes designed to measure skin temperature, air temperature, and air velocity.



Package boiler unit installed quickly

K17 Type H pre-assembled, water-tube steam generators manufactured by the Bigelow Co. are shipped complete—ready to operate as soon as service connections are made. The unit package includes drums, tubes, refractory, steel casing, burner, controls, automatic safety detectors, and soot blowers. No special foundations are necessary since the heavy steel base, which functions as a skid for erection, acts as a support when the boiler is in place. Fired by oil or gas, the boiler is a two drum design with vertical bent-tube arrangement and a water cooled furnace. The unit is adaptable to outdoor service and can be moved easily because of its compact design.

Ceiling supports unnecessary for lighter unit heaters

K18 An improved line of vertical delivery unit heaters for steam and hot water has been announced by Modine Manufacturing Co. Lighter weight—the largest model with a capacity of 600,500 Btu per hr weighs only 284 lb—makes for ease of handling during installation and eliminates structural ceiling supports required for mounting heavier units. The heaters feature circular casings and coils, increased heat transfer capacity as related to motor hp, stepped-up air volume and velocity, and outlet air temperatures in the 110 to 120 F range.

TO REQUEST ADDITIONAL DATA

Circle "key" numbers on reply card between pages 34 and 35. Your requests will be handled promptly.

Switch features front operation

K19 To permit space-saving installations by recessing, or by close-ganging, Federal Electric Products Co. has developed a 200 amp front-operated safety switch. In addition, the unit features an oversize handle that shows up distinctly from a distance, providing positive indication of switch position. Units are available for use with 250 and 600 v lines. In addition to the new 200 amp unit, switches are available with ratings of 30, 60, and 100 amp.

Tube insert assures improved connections

K20 Tight connections between Swagelok fittings and flexible plastic tubing is provided by a tube insert developed by Crawford Fitting Co. Resistance to chemical action and contamination makes this combination particularly useful for handling liquid food products and piping water, gasoline, and various oils and solutions. The Swagelok inserts are furnished for 3/16 in. OD fittings and larger.

Continuous flow possible with differential feeder

K21 Without stopping the processing operation, it is now possible to feed bulk materials into and out of a pressure or vacuum chamber by means of the Collins-Adey Feeder developed by John T. Collins & Co. The unit is mechanically operated and moves material by gravity or mechanical means through an intermediate pressure lock from one pressure to another. Individually designed to meet specific processing needs for free flowing or slow moving materials, the differential pressure feeder will continuously move materials from a high vacuum to atmospheric pressure or from atmospheric pressure to compressions as high a 10,000 psi.

Small flow reducing valves have wide application

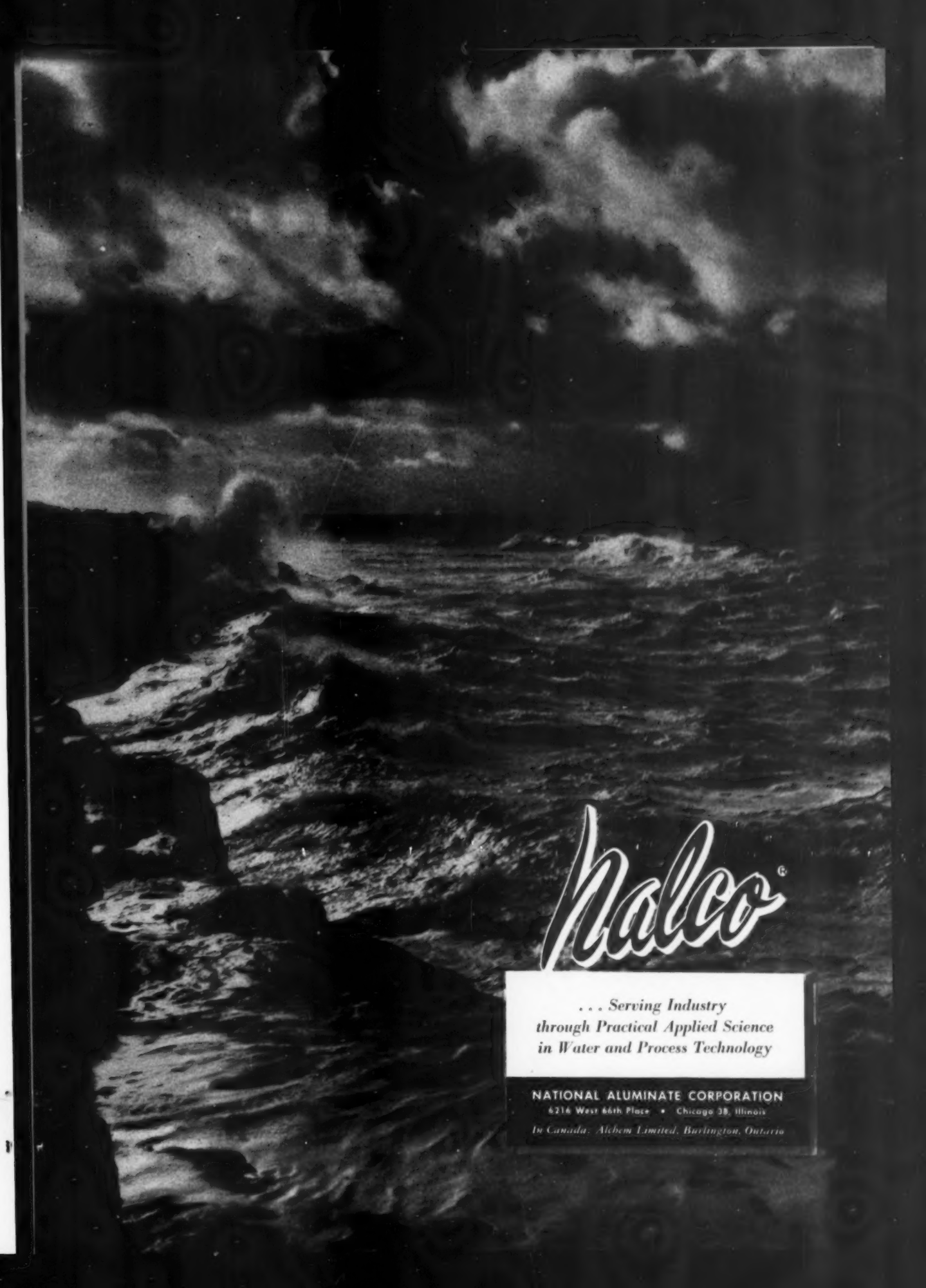
K22 Small flow bronze or steel reducing valves for steam, air, gas, or liquid service have been added to the Leslie Co. line. They are said to have a variety of applications in molding plants, pilot plant operation, laboratory units, sterilization plants, and other fields where small flows are necessary, and will handle inlet pressures to 1000 psi and reduced pressures from 2 to 400 psi. Complete capacity tables for four sizes of controlling valves from $\frac{3}{32}$ to 5/16 in. are included in a bulletin.

Stainless steel pump eliminates contamination

K23 Vanton Pump Corp. has developed a self priming stainless steel pump, known as the S series, which eliminates stuffing boxes, gaskets, and internal check valves. Since only the stainless steel block and corrosion resistant liner contact the fluid, the units are adaptable for extreme corrosive service and for handling foods or other liquids which must be kept pure. The "flex-i-liner" is available in a variety of rubbers and plastics. Capacities of the pump are $\frac{1}{8}$ to 20 gpm with discharge pressures from 0 to 60 psi and suction lifts up to 26 in. Hg.

(Continued on page 16)

Circle 507 on Reply Card for more data ⟶


Nalco®
. . . Serving Industry
through Practical Applied Science
in Water and Process Technology
NATIONAL ALUMINATE CORPORATION
6216 West 66th Place • Chicago 38, Illinois
In Canada: Alchem Limited, Burlington, Ontario

ELLIOTT TURBINES

Elliott 360-hp, 3550-rpm turbine driving a boiler-feed pump in a paper mill, exhaust steam being used in process.

Elliott 500-hp turbine driving a hydraulic system pump in a steel mill. Turbine maintains constant pump discharge pressure.

One of a group of Elliott turbines driving lean oil pumps in a cycling plant, where reliability is especially important.

A standard turbine— yet "tailor-made" to your requirements

Elliott Turbines can be adapted to practically any operating condition or service

That's because these powerful, compact turbines are designed to give you the advantages of custom-built adaptability at savings achieved through mass production of standardized parts. A wide variety of permissible modifications are possible. For instance... five sizes of YR turbines cover the entire range of capacities up to 2000 hp, speeds from 800 to 7000 rpm and back pressures from 4 in. Hg to 250 psig. Standard designs of rotor, governor, bearings, bearing cases, steam chest, governor valves and governor linkage are used throughout. In the case of higher pressures and temperatures up to 850 psig and 900 F, materials for steam parts may be changed from cast iron to steel.

Here are a few of the design highlights that are included in Elliott turbines:

Air-wall labyrinth seals to protect bearings from contamination without rubbing contact.

Centerline support to provide constant alignment under any operating condition.

Stainless steel spray coating under packing glands to eliminate corrosion of the shaft.

Choice of many governors to meet specific control requirements.

Liner type bearings to eliminate the need for scraping and fitting.

Packing glands removable without raising turbine upper half casing to simplify inspection and maintenance operations.

Stainless steel buckets and shroud to assure maximum life and continued high efficiency.

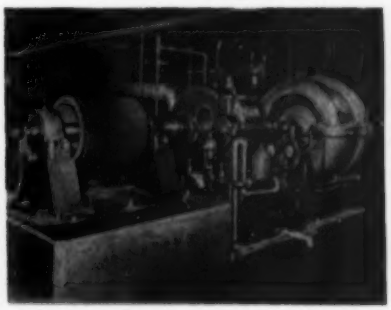
These and many other features are *standard* in Elliott turbines. They are the result of years of practical experience in the application of turbines to hundreds of different types of plant equipment and to many different types of operating and steam requirements.

Full details on Elliott Mechanical Drive Turbines can be obtained from your local Elliott representative or by writing Elliott Company, Jeannette, Pa., for a descriptive bulletin.

ELLIOTT Company
STEAM TURBINE DEPARTMENT

H3-11

This Elliott 202-hp turbine drives an induced-draft fan through a separate reduction gear, in a midwestern generating station.



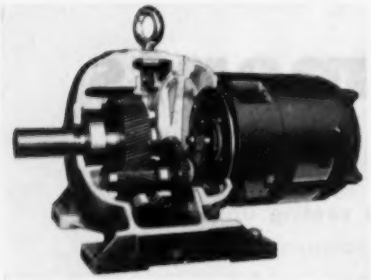
An Elliott 250-hp geared multi-stage turbine driving a paper machine. Governor gives close regulation over a wide speed range.

Circle 508 on Reply Card for more data

This line of oil pumps is driven by Elliott turbines. This is one of many refinery applications for Elliott turbines.

new equipment

(Continued from page 12)

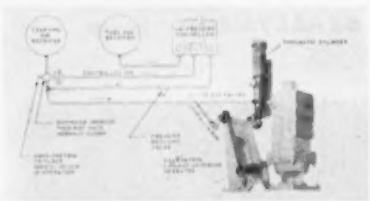


Gearmotors available in wide range of speeds

K24 Added to the lines of Century Electric Co. is a series of integral gearmotors from 1 to 15 hp with single, double, or triple gear reductions. The motors are available in a wide range of constant or variable speeds and with protective frames to operate under most atmospheric conditions. Gears meeting AGMA Class I, II, and III specifications are made to handle varying load requirements.

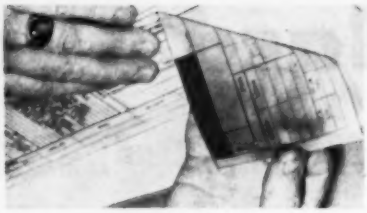
Compound permits greater welding flexibility

K25 To permit greater welding flexibility by effectively promoting uniform penetration and eliminating the harmful effects of air on the underside of welds, General Electric Company's Welding Dept. has developed a silicone weld-backing compound. The product is well suited to applications where the underside of the joint is difficult or impossible to reach for cleaning. Made from "bouncing putty," it is similar to paint in appearance. One coat, ½ in. wide, applied with a brush to the back of the joint, will give adequate protection.



Unit assures steady generator service

K26 When gas pressure drops below normal or fails completely, an engine equipped with the Worthington Corp.'s Automatic Fuel Switcher changes over to 100 percent fuel oil instantly. Whether operating on gas with pilot oil or 100 percent oil, the unit places the engine under command of the governor with full travel at its best governing efficiency, thus eliminating erratic regulation on generator service.



Printed plastic sheets shorten drafting time

K27 Thin, transparent, printed plastic sheets which can be applied to paper, vellum, or cloth without the use of heat, have been developed by Johnson Research Corp., Bethpage, N. Y., to eliminate time-consuming hand lettering, symbol drawing, and ruling required for engineering drawings. Known as Transeals, the sheets are coated with a pressure-sensitive adhesive protected by a removable waxed paper sheet. They can be furnished for application to either the reverse side or the face of drawings. Type, rule lines, and symbols can be prepared to meet individual specifications. Samples will be sent on requests written on company letterhead.

TO REQUEST ADDITIONAL DATA

Circle "key" numbers on reply card between pages 34 and 35. Your requests will be handled promptly.

Safety suit used at 400 F

K28 Production continues uninterrupted during manual adjustments to a gas furnace with the use of a safety suit developed jointly by the Safety Dept. of Walter Kidde & Co., Inc. and the Guardian Safety Equipment Co. The outfit, in use at the Kidde Co., permits a man to work comfortably at temperatures up to 400 F for as long as 45 minutes. The body of the suit is coated with aluminum paint, which reflects 90 percent of the heat while the gloves resist heat to 1600 F. Air is supplied by an air purifier and pressure reducer connected to a compressed air line.

Conveying system operates at lower cost

K29 An improved pneumatic conveying unit for handling bulk materials has been announced by Sprout, Waldron & Co. Called the Pneu-Vac, it operates with negative pressure or draw-through by means of two-stage radial fans which are said to make possible longer runs and higher capacities at lower cost. The unit is self-cleaning, and when equipped with an auxiliary multi-tube filter, will collect all visual dust. Twelve standard sizes with fan motors of 2 to 60 hp and capacities up to 50 tons an hour have handled runs of 300 ft and over.

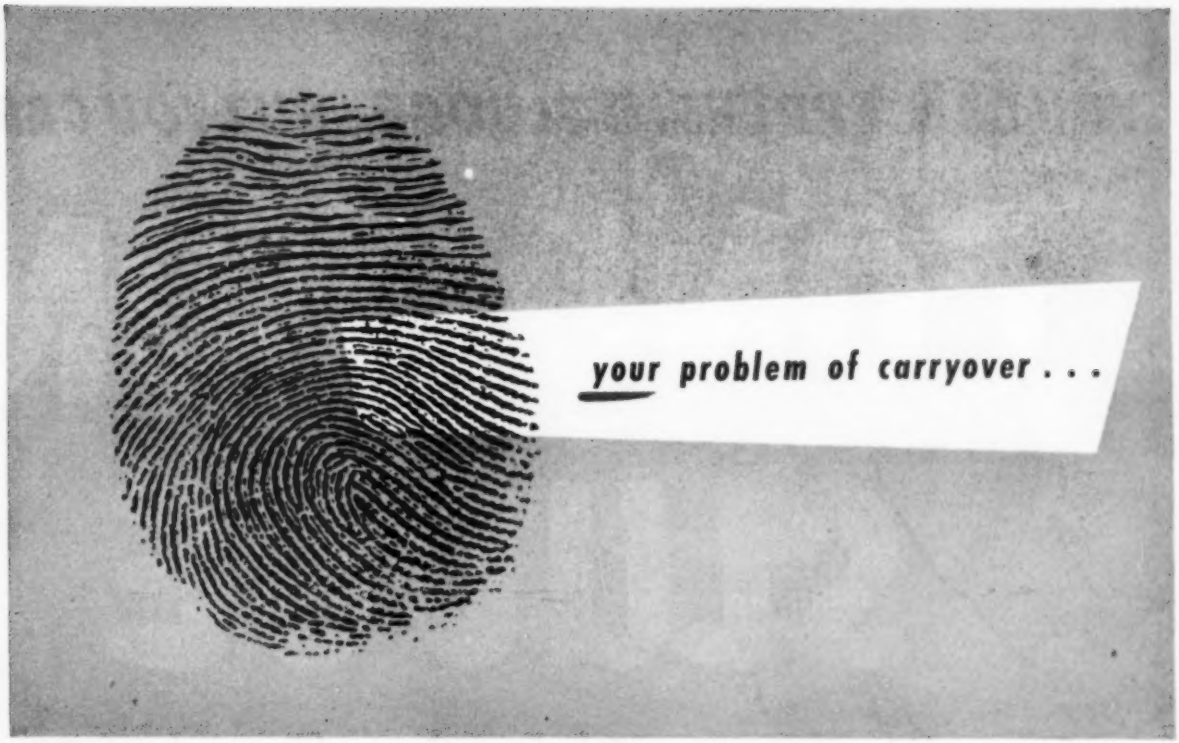
Primary switch saves power

K30 Fast range-changing without unplugging leads or making connections is possible with the range switch on Metal and Thermit Corporation's redesigned welders. The 300 and 500 amp, a-c units are fan cooled and save power by means of a primary switch which permits turning off current at the machine between welds.

Torque wrenches provide lower capacities

K31 Availability of both inch-pound and foot-pound torque-limiting wrenches provides suitable torquers for practically any type of installation or inspection work, according to the manufacturer, Plomb Tool Co. The new Proto inch-pound models release at the

(Continued on page 20)



. . . is as individual as a fingerprint. No two problems are alike and there is no standard solution. However, with a comprehensive engineering approach and application of selected anti-foam agents, even an extremely difficult problem can be overcome.

To illustrate the point, a steel mill boilerhouse operating on 100% make-up water, produced 6,000,000 pounds of steam daily to operate its turboblowers. Continuous carryover of boiler water solids with steam was encountered. Regulators and valves were coated with heavy deposits. Frequent slugs of water passed through the superheaters into the turboblowers. And, the superheater temperature charts literally resembled a picket fence!

Betz Engineers recommended the application of proper anti-foam agents and effected a remarkable improvement. Carryover has been *eliminated*, and superheater temperature has been *increased* approximately 50 degrees.

Why not ask a Betz Engineer today to explain how anti-foam agents can help solve your own particular carryover problem and save you time, money and effort in your plant? Ask him too, about the complete Betz *Specialized* Water Conditioning Service tailor-made to your needs. W. H. & L. D. BETZ, Gillingham and Worth Streets, Philadelphia 24, Pa. In Canada: BETZ Laboratories Limited, Montreal 1.

Betz Technical Paper 115 "Carryover Prevention With Anti-Foam Agents" is free for the asking. Write for a copy today.

BETZ

CONSULTANTS ON ALL WATER PROBLEMS

Circle 509 on Reply Card for more data

YOU CAN'T PREVENT SLUDGE...BUT YOU CAN

CONDITION SLUDGE

...with Dearborn Formula 659

● Sludge—the ever-present thief of boiler efficiency—can be controlled with Dearborn's sludge-conditioning Formula 659.

IMPORTANT FUNCTIONS OF FORMULA 659

PREVENTS sludge from adhering to boiler surface.

PROVIDES colloidal action; prevents crystalline scale formation.

PRODUCES better quality steam by modifying bubble formation responsible for foaming conditions.

ELIMINATES corrosion in feed lines, heaters and internal boiler surfaces caused by dissolved oxygen.

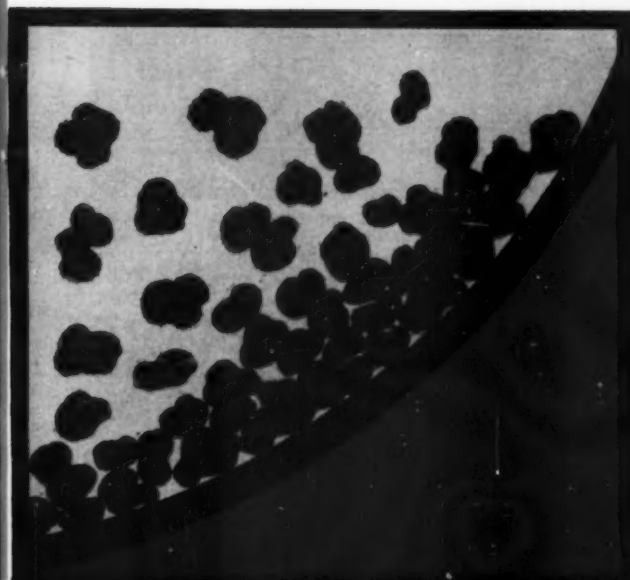
Compatible with other treatments, this Dearborn formula will greatly reduce maintenance and production costs.

Dearborn

TRADE MARK

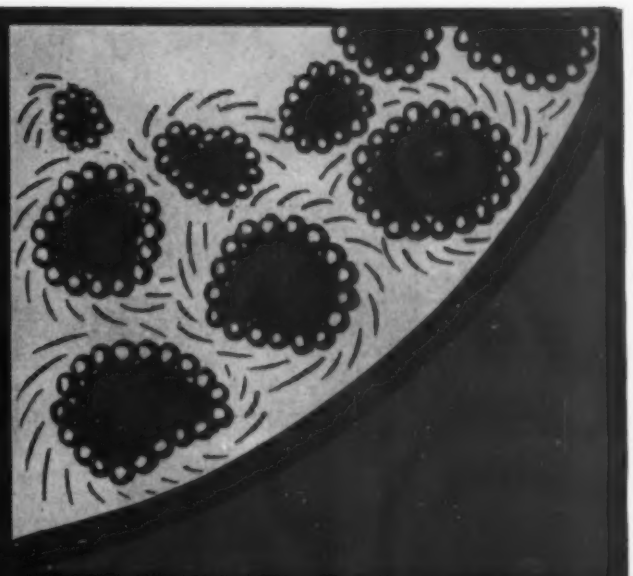
COMBATTING CORROSION EVERYWHERE SINCE 1887

DEARBORN CHEMICAL COMPANY · Merchandise Mart Plaza, Chicago 54, Illinois



THIS IS UNCONDITIONED SLUDGE

Untreated sludge particles settle into a compact mass, preventing water contact with metal surfaces and producing sludge-type scale.



THIS IS CONDITIONED SLUDGE

Treated sludge particles, surrounded by water molecules, produce fluid and non-adherent particles which prevent packing and attachment.

DEARBORN FORMULA 134 REMOVES SCALE

Many waters tend to form scale in pipes and cooling jackets, impairing valuable equipment, adding unnecessary labor and shutdown time. Formula 134, a concentrated solvent, removes scale in heat exchange units, boilers, pumps, feed lines, meters and condensers! Bulletin 5002 describes removal of scale with Dearborn Formula 134.

DEARBORN Filmeen Stops Return Line Corrosion

If corrosion makes frequent replacement of return lines, fittings and other equipment necessary, your plant engineer will want to know more about corrosion control with Dearborn Filmeen . . . Bulletin 5013 gives the complete story.

your Dearborn Engineer

will visit your plant, analyze the pertinent waters, make recommendations for the proper treatment and the equipment necessary to establish a simple control that eliminates unnecessary expense.

WRITE FOR THESE VALUABLE BULLETINS

Dearborn Chemical Company — Dept. INP
Merchandise Mart Plaza
Chicago 54, Illinois

Please send me

- ☐ Bulletin 5008-A—Dearborn Formula 659
- ☐ Bulletin 5000 —Dearborn Industrial Water Treatment and Engineering Service
- ☐ Bulletin 5013 —Dearborn Filmeen
- ☐ Bulletin 5002 —Dearborn Formula 134
- ☐ Have a Dearborn Engineer call

Name.....

Position.....

Company.....

Address.....

City.....*State*.....

Circle 510 on Reply Card for more data

Another Beaumont Birch Ash Handling Installation

Discharge end section of a flooded hopper for Beaumont hydraulic system showing rugged supporting structure and circular protected observation ports of special heat resistant glass.

Why BEAUMONT BIRCH Hydraulic Ash Handling Systems Assure You

Reliable, Efficient Service

In every detail of Beaumont Hydraulic Ash Handling Systems, you'll find they're designed for practical considerations of boiler efficiency, operating safety, minimum man-hour attention and minimum maintenance.

For example, on flooded hoppers beneath pulverized coal fired boilers, costly shut downs are never necessary when water jet nozzles in the ash hopper require replacing. They are easily and safely replaced *while the boiler is in operation* . . . the rugged sluice gate and operating cylinder are mounted on a single casting, completely shop assembled. This assures perfect alignment of cylinder for long uninterrupted service.

On flooded hoppers, operators are always protected at observation ports by special glass resistant to thermal shock, in addition to a protecting metal guard. Built-in spray washers keep all observation ports clean and free from dirt and fog.

These and many other points, such as, sluiceways, sumps, dewatering bins, flyash handling systems and other supplemental equipment are only a small part of the attention to details that are characteristic of Beaumont Birch Systems.

Power and Consulting Engineers specify Beaumont Birch Hydraulic Ash Handling Equipment because they are assured of design, engineering and construction to exacting specifications!

Beaumont's background of over fifty years in the design and manufacture of ash handling systems gives you long service life with a minimum of maintenance.

For complete details of the many efficiency and economy features of Beaumont Hydraulic Ash Handling Systems, call in a Beaumont Birch engineer or write direct.

Beaumont BIRCH COMPANY

1509 RACE STREET, PHILADELPHIA 2, PA.

DESIGNERS — MANUFACTURERS — BULK MATERIAL HANDLING SYSTEMS

Circle 511 on Reply Card for more data

new equipment

(Continued from page 16)

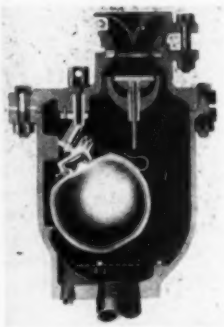
proper setting and reset themselves automatically. No projecting dial, pointers or scales are used. Capacities are 100 to 750 and 700 to 1600 in-lb, with the Model RV-6 indicating type, ratchet head. Drive sizes ⅜ and ½ in.

Gas alarm system warns of danger

K32 Sequential sampling of potentially explosive atmospheres from six separate locations is possible with the Model RV-6 indicating type, combustible gas alarm system, according to the manufacturer, Johnson-Williams, Ltd. When combustible gas or vapor reaches a pre-selected level, the instrument stops cycling automatically, shows a red warning light, and energizes an external circuit to actuate a remote warning alarm. Models are available to permit sampling from 2 to 8 locations. Operation is from 115 v ac, 50 or 60 c.

TO REQUEST ADDITIONAL DATA

Circle "key" numbers on reply card between pages 34 and 35. Your requests will be handled promptly.



Air release and inlet valve is compact in design

K33 Type AV air release and vacuum breaking valve, has been designed by Simplex Valve and Meter Co. to provide automatic release of air accumulations from pipe systems, air admission to systems for breaking vacuums, and venting of large quantities of air from pipelines when filling systems with water. Usable under working pressures up to 150 psi, the valve is compact in design, having a maximum diameter of 11½ in., a 2 in. threaded inlet opening, and weighs 160 lb.

(Continued on page 26)

COPPUS "BLUE RIBBON" VENTILATORS

Used in wide variety of applications throughout industry

Improve workers' safety . . . health . . . comfort . . . efficiency

VANO DESIGN "A" VENTILATOR is used here during repairs to a chemical still. This type ventilator is used to ventilate tanks, tank cars, drums, vats, underground cable manholes, pipe galleries, airplane wing compartments, fuselages and other confined places. Uses 8" diameter flexible canvas tubing ("Ventube").

VANO DESIGN "B" VENTILATOR here discharges welding fumes from double-bottom compartment in naval vessel under construction. Large volume of air handled quickly expels fumes and results in good ventilation. Vano Design "B" can pass through opening only 14" in diameter. Uses 8" diameter flexible canvas tubing ("Ventube").

VANO DESIGN "C" VENTILATOR here withdraws fumes from a reactor kettle. This ventilator can be furnished with 8" suction inlet for 8" non-collapsible suction tubing — or multiple inlet nozzles for 5", 4", and 3" suction hose. The discharge may be connected to 8" "Ventube." Capacities furnished on request.

NO. 2 AEROPLANE HEAT KILLER here directs cool, fresh air on worker in drop forge plant. Heat killers restore workers' efficiency by providing extra ventilation in the hot months, or on any job where workers are continually or periodically required to work in excessive heat. Available in two types, three sizes in each.

VENTAIR DESIGN TE-4 VENTILATOR Gasoline Engine Driven, here delivers air into underground manhole. These ventilators provide fresh air to men in confined places, promoting safety, comfort, and increasing efficiency. Ideal where no electric current is available. Delivers 1700 CFM of fresh air. Uses 8" diameter flexible canvas tubing ("Ventube").

PORTAIR NO. 4 BLOWER EXHAUSTER exhausts fumes resulting from soldering, welding, tank coating, is also used in ventilating small tanks. It is designed to permit attachment of 4" flexible metal hose. Capacity: 425 CFM free air.

ATTACH THIS COUPON TO YOUR COMPANY LETTERHEAD

190 PARK AVENUE, WORCESTER 2, MASS. Sales offices in Thomas' Register. Other "Blue Ribbon" Products in Chemical Engineering Catalog, Refinery Catalog, Best's Safety Directory and Mining Catalogs.

Please send me information on supplying fresh air to men working:

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes
- ☐ in aeroplane fusilages, wings, etc.
- ☐ on coke ovens
- ☐ on steam-heated rubber processes
- ☐ on boiler repair jobs

COOLING:

- ☐ motors, generators, switchboards
- ☐ wires and sheets
- ☐ general man cooling
- ☐ around cracking stills
- ☐ exhausting welding fumes
- ☐ stirring up stagnant air wherever men are working or material is drying
- ☐ drying of walls, sheets, etc., after treated with coating material

Name .....

Company .....

Address .....

City .....Zone....State.....

Write here any special ventilating problem you may have { _____ _____

Circle 512 on Reply Card for more data

what 900,000 impulse® steam traps are doing for Industry...

Over 900,000 Yarway Impulse Steam Traps have been bought for use throughout industry.

Yarway Impulse Traps are popular because they are small and lightweight . . . easily installed. They require but little maintenance. Body and all working parts are stainless steel. A trap can be serviced and back in the line in 5 minutes.

Yarways are good for all pressures without change of valve or seat. They will not freeze up. Initial cost is low.

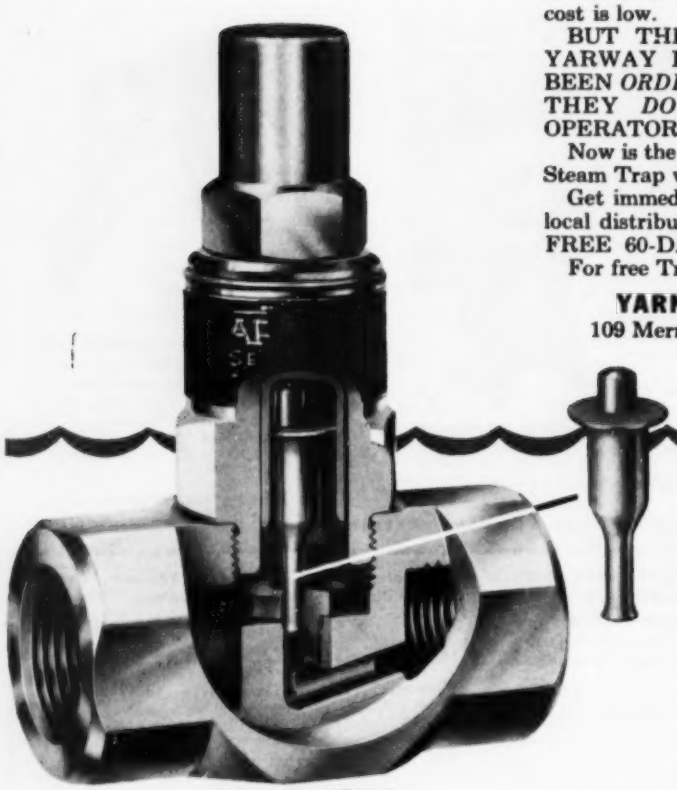
BUT THE BIGGEST REASON SO MANY YARWAY IMPULSE STEAM TRAPS HAVE BEEN *ORDERED* AND *REORDERED* IS WHAT THEY *DO* FOR PLANT OWNERS AND OPERATORS.

Now is the time to find what the Yarway Impulse Steam Trap will do for you.

Get immediate delivery from the nearest of 250 local distributors. Name on request. Ask about the FREE 60-DAY TRIAL OFFER.

For free Trap Selector, write,

YARNALL-WARING COMPANY
109 Mermaid Avenue, Philadelphia 18, Pa.



ACTUAL SIZE ¾" TRAP

it floats on the load!

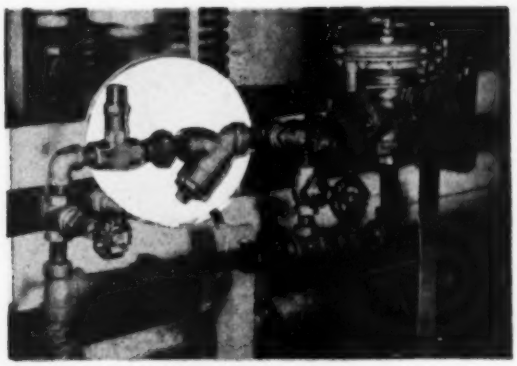
● This little valve—the only moving part in the Yarway Impulse Steam Trap—actually floats on the condensate load, keeping hot steam in the equipment every minute of operating time. That's why Yarway Impulse Steam Traps *get equipment hot in a hurry, and keep it hot.*

YARWAY®

▲ **PRODUCTION INCREASED 30%** when ***RECORD MANUFACTURER*** put Yarway Impulse Traps on presses.

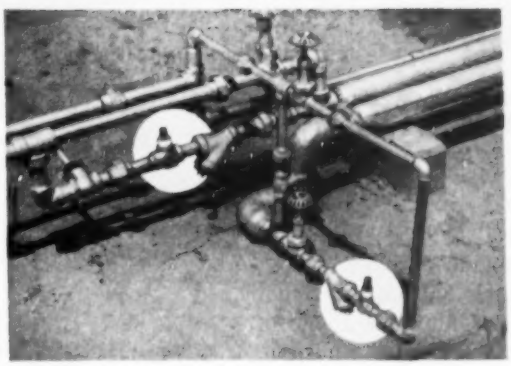
▲ **TONNAGE INCREASED 35%** at tar bath vat after ***PIPE FOUNDRY*** installed Yarway Impulse Traps.

50 FT. MORE FLAT-WORK PER MINUTE after ***LAUNDRY*** equipped 8-roll ironer with Yarway Traps. ▼



▲ **FASTER HEATING** on slashers, and **EVEN TEMPERATURES** on dry cans experienced by ***TEXTILE PLANT*** after switching to Yarway Traps.

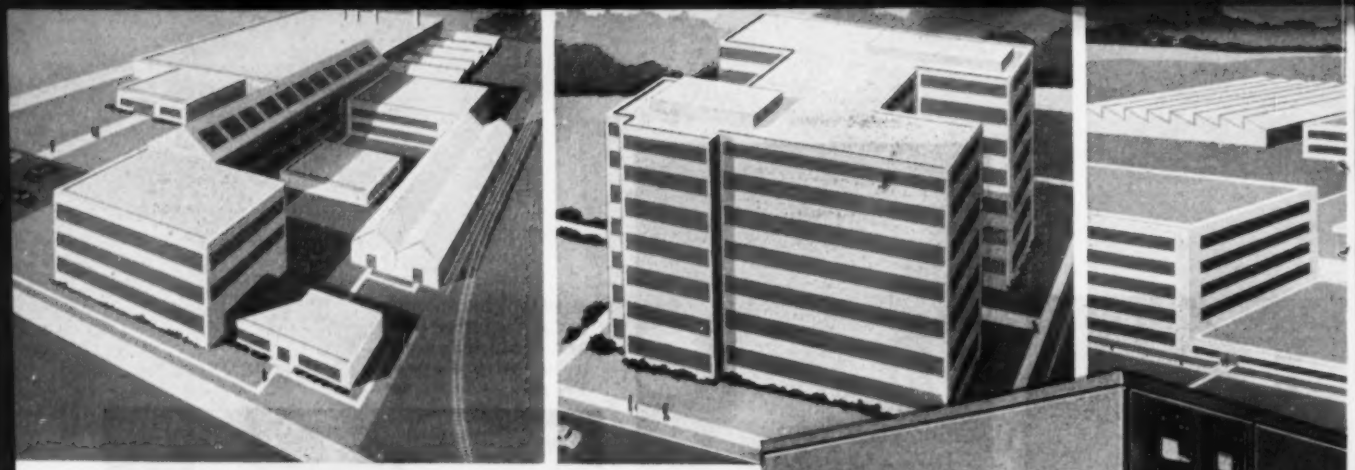
5 MORE BATCHES PER DAY from cooking kettles when ***TOMATO CANNERY*** installed Yarway Traps. ▲

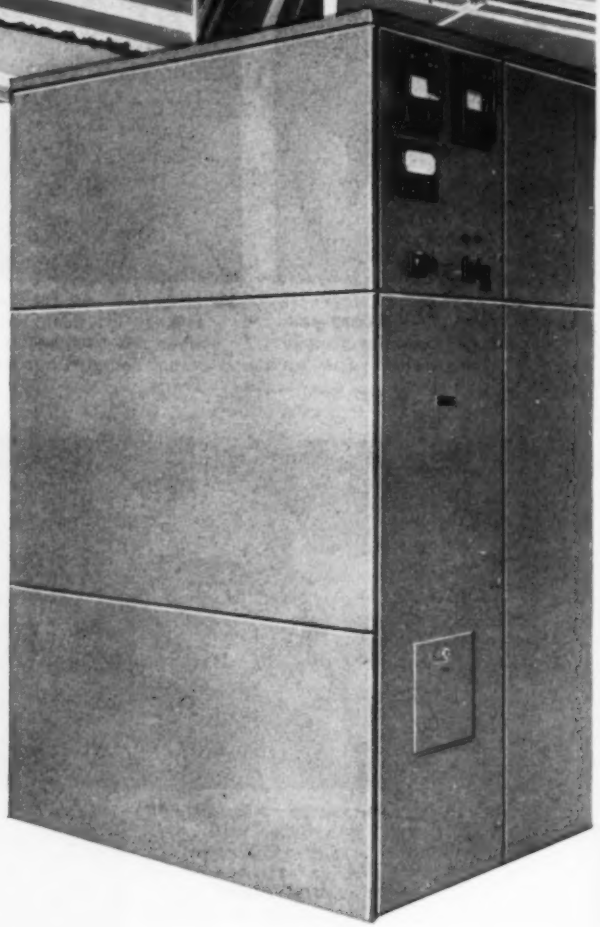


◀ **FREEZE-UPS ELIMINATED** after putting Yarway Impulse Traps on outside lines at ***PETROLEUM PLANT.***

impulse® steam traps

Circle 513 on Reply Card for more data

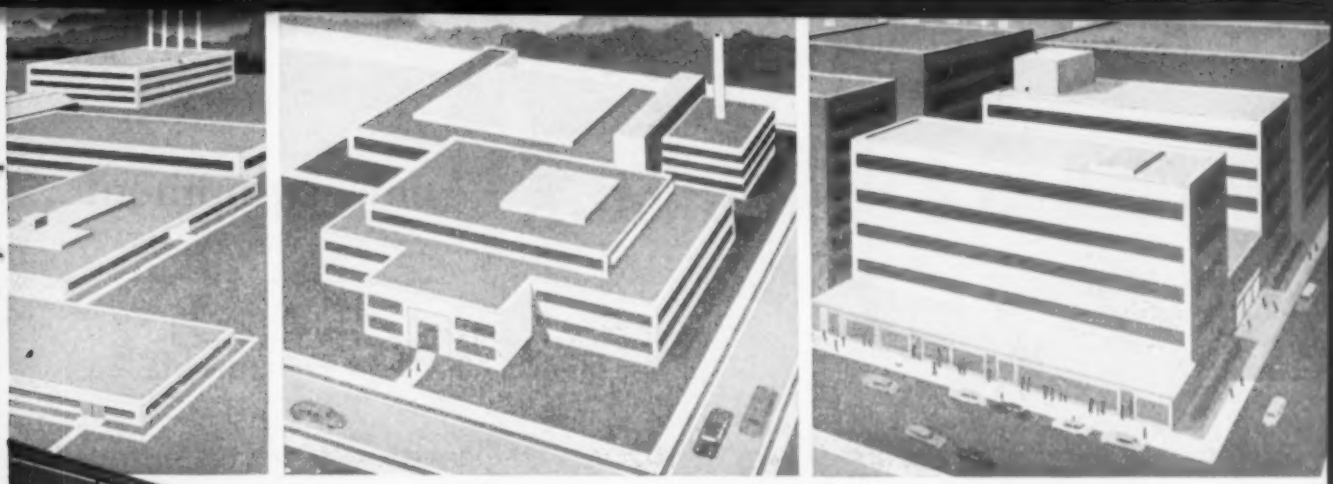


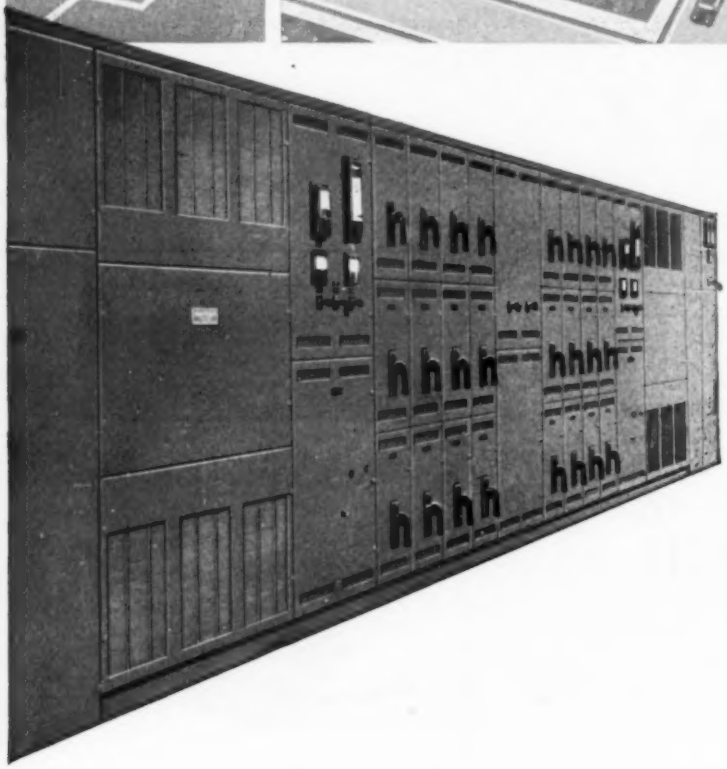


AS VITAL AS YOUR PLANT'S FOUNDATION

unit substations are basic plant investments

In central stations, industrial plants, or buildings—engineering management recognizes the need for power distribution equipment which is safe, dependable, economical, and adaptable. To Unit Substations, forming the *nerve centers* of any distribution system, is delegated the important responsibility of providing continuous power and circuit protection for years to come. Unit Substations, therefore, should not be merely *adequate*, but they must have quality to be a sound, *profitable* capital investment.





I-T-E offers a complete line of quality unit substation equipment

Through the years, I-T-E has led in the development and manufacture of quality circuit breakers and switchgear. Similarly, since the inception of the Unit Substation, and its use in modern distribution systems, I-T-E has continued to hold this same envied position. Today, I-T-E supplies a full line of quality Unit Substations, in types and sizes to fit every application.

As an *extra service*—to help users make the wisest investment possible—I-T-E furnishes engineering assistance in the selection and application of equipment, preparation of specifications, and coordination of all job requirements. There are I-T-E Application Engineers in every major industrial area for this purpose.

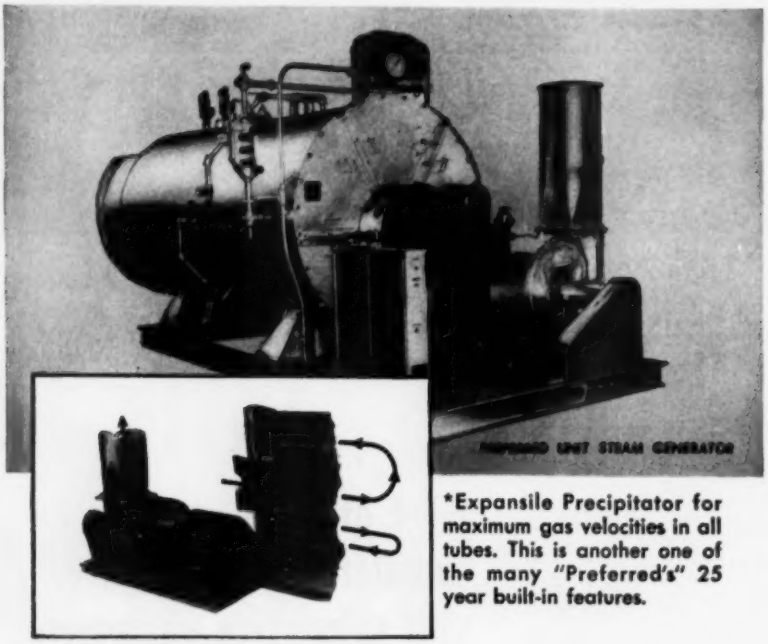
To find the I-T-E field office nearest you, look in the classified section of your telephone directory under "Electrical Equipment."

I-T-E Circuit Breaker Co., 19th and Hamilton Sts. Philadelphia 30, Pa.

UNIT SUBSTATIONS

Circle 514 on Reply Card for more data

there IS a difference...*



*Expansile Precipitator for maximum gas velocities in all tubes. This is another one of the many "Preferred's" 25 year built-in features.

PREFERRED *can do the job* and do it BETTER!

Another one of a long list of *exclusive* "quality features" of the Preferred Unit Steam Generator is the Expansile Precipitator which helps "Preferred" to do the job better . . . because it is designed and engineered to perform better!

This Preferred component enables maximum gas velocities to be equally maintained in all tubes of the pressure vessel. This is particularly important in the last pass where any drop in velocity (due to obstructions or insufficient mechanical impetus) results in rapid build-up of deposits. The expansile precipitator prevents this build-up, thus minimizing maintenance costs. The Preferred Expansile Precipitator is your overall insurance for clean, smokeless operation and healthful working conditions . . . trapped impurities *cannot* escape to surrounding areas.

The Preferred Generator gives economical, low-maintenance service at *a minimum guaranteed efficiency of 80%* . . . for twenty-five years. The Preferred Unit Steam Generator is insurance for optimum combustion based on automatic and simplified operation.

— This is only one of the many "quality features" described in Bulletin 2000 . . . for complete details send for your copy today.

PREFERRED UTILITIES MFG. CORP.

411 1860 BROADWAY • NEW YORK 23, N. Y.

Circle 515 on Reply Card for more data

new equipment

(Continued from page 20)

Magnetic clutch used with a-c motor drives

K34 Smooth, stepless speed variation up to full motor output rpm is provided by the Kysor Hysteresis Magnetic Clutch, according to the manufacturer, June & Co. On a-c motor drives, the clutch eliminates the necessity for motor-generator sets used with d-c motors in heavy duty applications. No water cooling is required. It is available in sizes 1½ to 20 hp for both integral combination motor-drive units in one housing, and transmission type units with separate motors.

TO REQUEST ADDITIONAL DATA

Circle "key" numbers on reply card between pages 34 and 35. Your requests will be handled promptly.

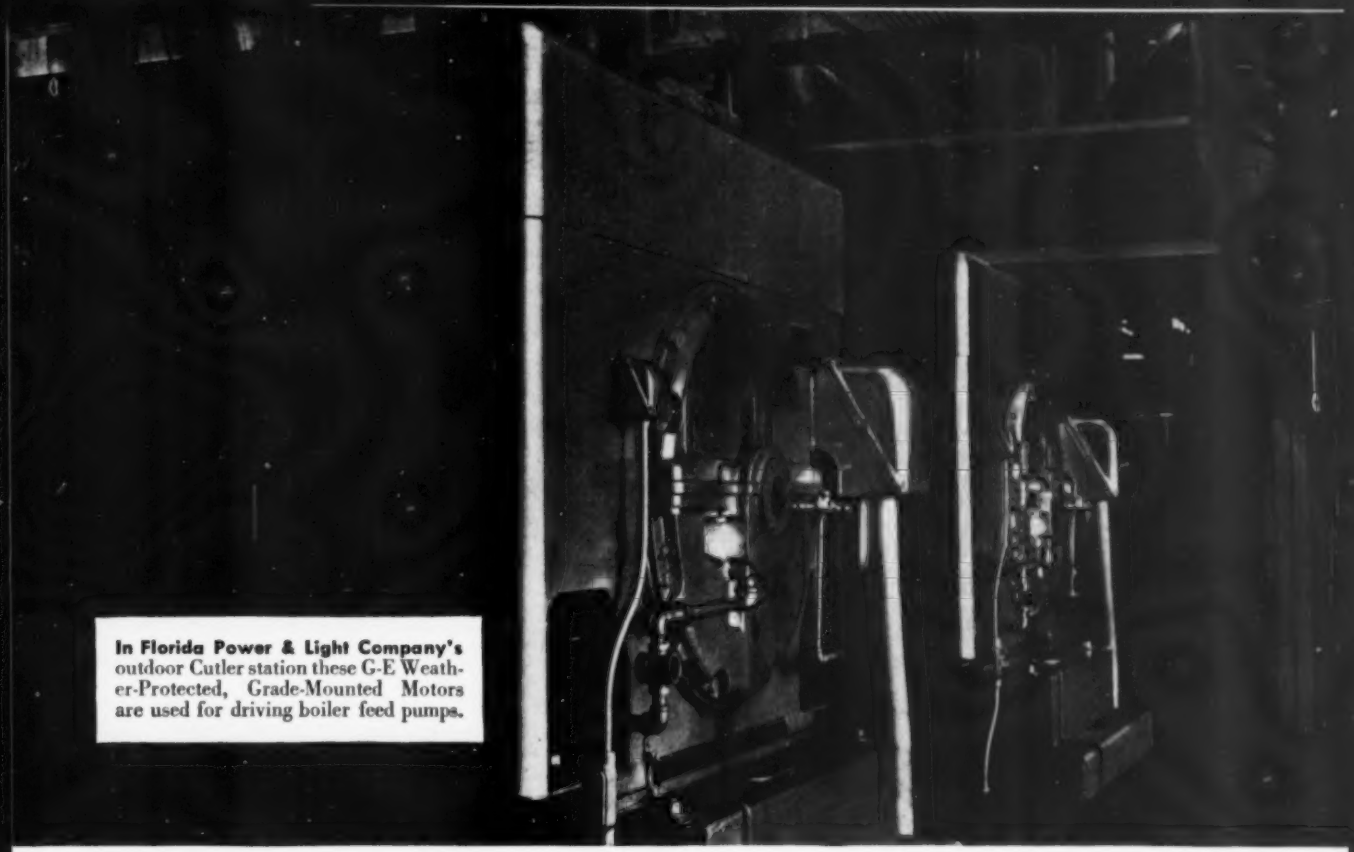
Bending machine operated by trigger switch

K35 Die forms can be quickly and easily changed for ½ to 1¼ in. pipe in the No. 60 power portable bending machine, made by Wallace Supplies Manufacturing Co. A drill press ¾-hp motor actuates the bending in either forward or reverse rotation to 180 deg by means of a trigger switch. Operated by one man, the machine will average 60 bends per hr. It operates on 115 v single phase, 60 cycle ac or dc.

Robot-eye units monitor rolling process

K36 Radiation detection devices comprise the heart of a newly developed robot system 10 times faster and 2 to 5 times more accurate than previous means of monitoring critical temperatures during uranium rolling operations, according to Minneapolis-Honeywell Regulator Co. Known as radiametric pyrometers,

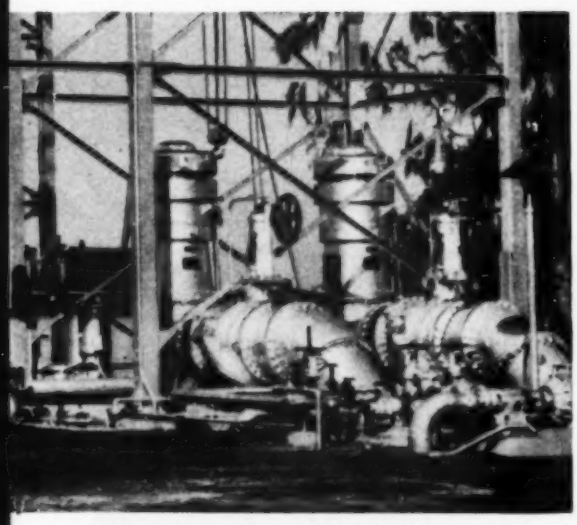
(Continued on page 30)



In Florida Power & Light Company's outdoor Cutler station these G-E Weather-Protected, Grade-Mounted Motors are used for driving boiler feed pumps.

Designed specifically for outdoor, all-weather applications . . .

G-E Weather-protected Motors Provide Vital Continuous Service



G-E Weather-Protected Vertical Motors coupled to circulating water pumps operate outdoors in all weather at Florida Power & Light Company's Palatka Station.

Here's a low cost motor that the weather can't stop. For vital outdoor power station service, you can always count on reliable performance from rugged G-E Weather-Protected Motors . . . in all kinds of weather. An extremely effective ventilating system minimizes entrance of rain, snow, sleet and other airborne particles. Windings and other internal parts stay dry . . . assure you of dependable, all-weather service at minimum installed cost.

You get another big plus from industry's first successful outdoor weather-protected motor . . . the long-life quality developed in building over 2½ million horsepower of motors for power stations.

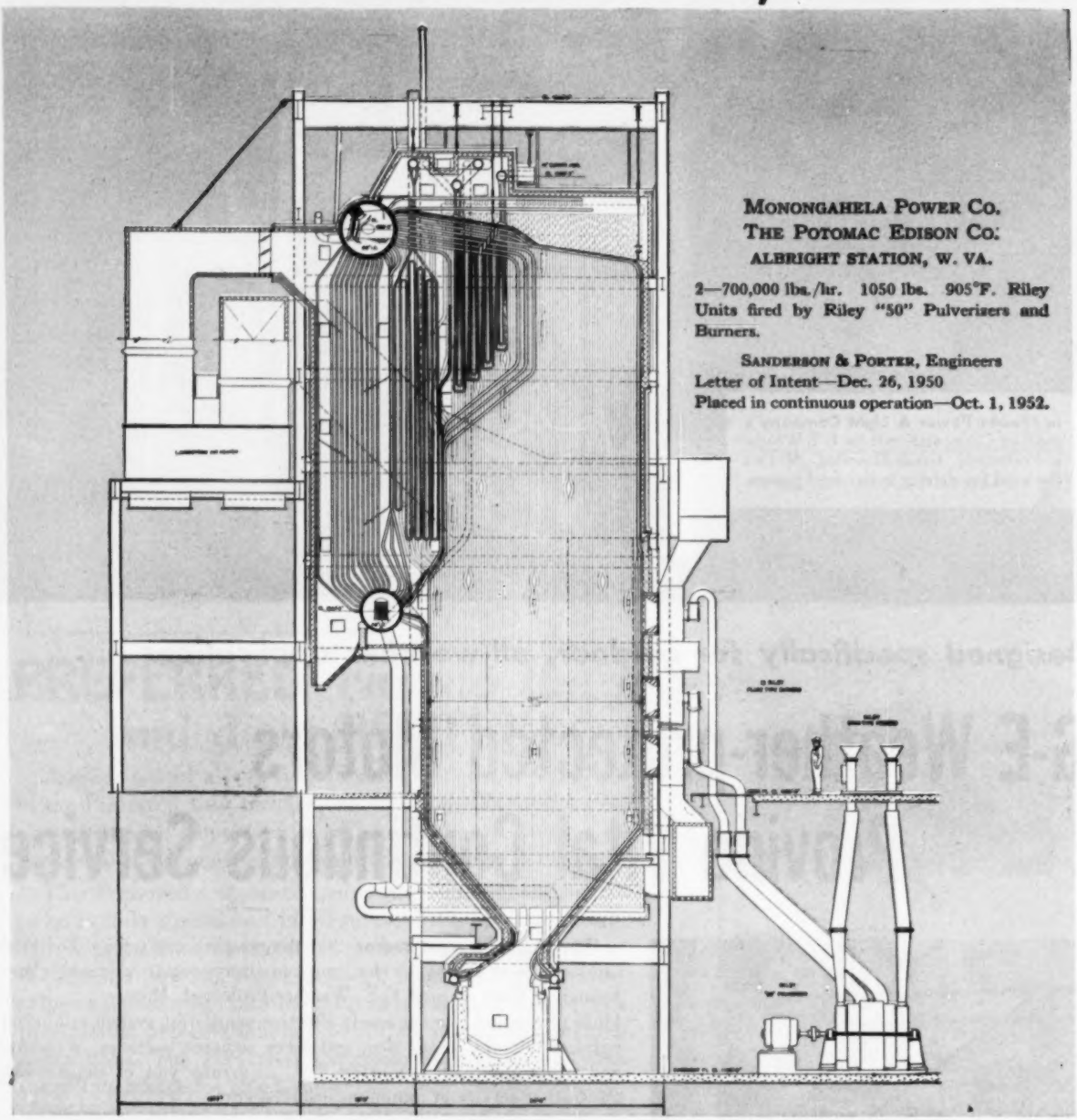
For complete information on these and many other features, contact your nearest G-E Apparatus Sales Office or write for Bulletin GEA-5810. General Electric Co., Section 753-5, Schenectady 5, N. Y.

You can put your confidence in—

GENERAL ELECTRIC

Circle 516 on Reply Card for more data

700,000 lbs./hr. Riley Units at



MONONGAHELA POWER CO.
THE POTOMAC EDISON CO.
ALBRIGHT STATION, W. VA.

2—700,000 lbs./hr. 1050 lbs. 905°F. Riley Units fired by Riley "50" Pulverizers and Burners.

SANDERSON & PORTER, Engineers
Letter of Intent—Dec. 26, 1950
Placed in continuous operation—Oct. 1, 1952.

TRADE MARK Rx REGISTERED

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston · New York · Philadelphia · Washington · Buffalo · Pittsburgh · Cleveland · Detroit · Chicago
Cincinnati · Charlotte · Atlanta · New Orleans · St. Louis · Kansas City · St. Paul · Tulsa · Houston
Denver · Salt Lake City · Los Angeles · Portland · Seattle

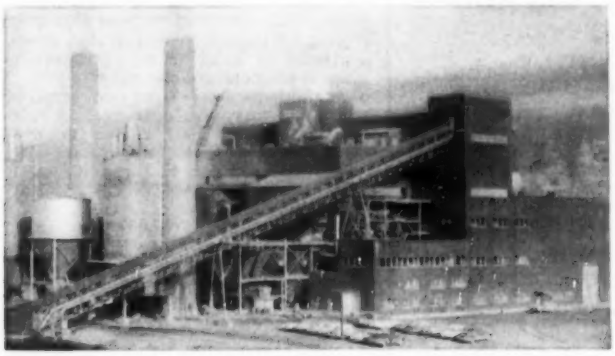
BOILERS · PULVERIZERS · BURNERS · STOKERS · SUPERHEATERS · ECONOMIZERS

Albright Station go on the line

21 months after letter of intent

A letter of intent dated December 26, 1950 was given Riley Stoker Corporation by Monongahela Power Co. and The Potomac Edison Company covering the first two 700,000 lbs./hr. units for their new Albright Station. In spite of the fact that this was a completely new station and the difficulties in procurement of materials, the first unit was placed in continuous operation October 1, 1952, only 21 months after date of award, performing as guaranteed and predicted, and without the necessity of shutdowns for adjustments or corrective measures.

It is because of performance like this—engineering, fabrication, erection and operation of the equipment—that so many public utilities and industrials have swung to Riley. By investigation and experience one after another has found that you can rely on Riley. Be sure to investigate Riley equipment and request a Riley proposal when considering new steam generating or fuel burning equipment. You will be glad you did so.



A Few Recent Riley Public Utility Units

TEXAS ELECTRIC SERVICE CO.
1,250,000 lbs./hr. 2125 psig, 1005°F. and 1005°F. reheat

DALLAS POWER & LIGHT CO.
1,250,000 lbs./hr. 2125 psig, 1005°F. and 1005°F. reheat

HOUSTON LIGHTING & POWER CO.
1,250,000 lbs./hr. 2125 psig, 1005°F. and 1005°F. reheat

DEPARTMENT OF WATER AND POWER CITY OF LOS ANGELES, CALIFORNIA
1,200,000 lbs./hr. 2075 psig, 1000°F. and 1000°F. reheat.

LOUISIANA POWER & LIGHT CO.
1,000,000 lbs./hr. 1725 psig, 1005°F. and 1005°F. reheat.

SOUTHWESTERN GAS & ELECTRIC CO.
630,000 lbs./hr. 1050 psig, 1005°F.

MONONGAHELA POWER CO.
700,000 lbs./hr. 1050 psig, 905°F.

UTAH POWER & LIGHT CO.
575,000 lbs./hr. 1700 psig, 1000°F. and 1000°F. reheat.

CENTRAL ILLINOIS LIGHT CO.
600,000 lbs./hr. 950 psig, 900°F.

NORTHERN STATES POWER CO.
385,000 lbs./hr. 1500 psig, 950°F.

SOUTH CAROLINA PUBLIC SERVICE AUTHORITY
460,000 lbs./hr. 1025 psig, 900°F.

THE POTOMAC EDISON CO.
700,000 lbs./hr. 1050 psig, 905°F.

IOWA ELECTRIC LIGHT & POWER CO.
300,000 lbs./hr. 975 psig, 910°F.

GULF POWER CO.
325,000 lbs./hr. 1000 psig, 900°F.

SOUTH CAROLINA GAS & ELECTRIC CO.
400,000 lbs./hr. 1475 psig, 955°F.

UTAH POWER & LIGHT CO.
620,000 lbs./hr. 1500 psig, 955°F.

IOWA-ILLINOIS GAS & ELECTRIC CO.
250,000 lbs./hr. 975 psig, 905°F.

PUBLIC SERVICE CO. OF INDIANA
400,000 lbs./hr. 1000 psig, 910°F.

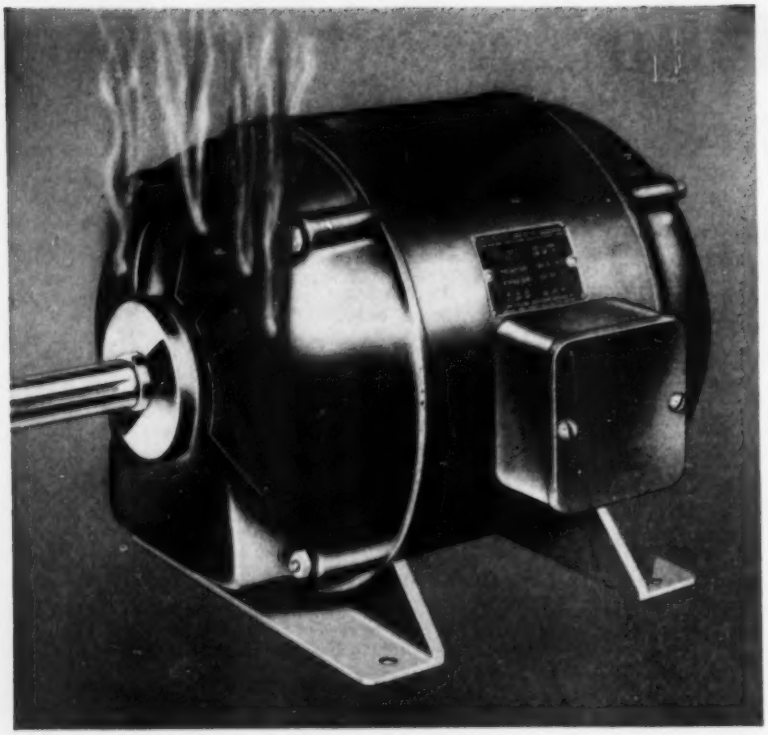
A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

Circle 517 on Reply Card for more data



You can avoid motor burnouts

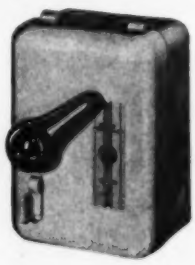
THE temperature surrounding motor protection equipment is an important factor in motor burnouts. In order to prevent nuisance stoppages in hot weather, the rating of protective equipment is often raised. Then, when plant temperature drops, protection is inadequate . . . motors are more subject to burnout.

This explains why an ever-increasing number of plants are standardizing on HEINEMANN Circuit Breakers as manual motor controllers. Set tripping points of HEINEMANN Circuit Breakers *are completely independent of ambient temperature.*

Moreover, HEINEMANN Circuit Breakers provide inverse time delay to permit starting inrush or harmless, temporary overloads . . . yet they provide the fastest circuit interruption available on large overloads, stalled rotors, single-phasing or short circuits.

HEINEMANN Circuit Breakers operate on a hydraulic-magnetic principle. They do not employ thermal elements or heaters. They are available with precise ratings to the motor, and are provided with time delay characteristics especially suited to trouble-free motor protection.

don't use heat ...USE POWER



Send for Bulletin 1410.

HEINEMANN ELECTRIC CO.

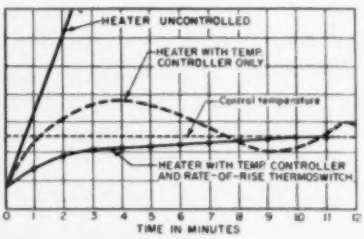
140 PLUM STREET • TRENTON 2, NEW JERSEY

Circle 518 on Reply Card for more data

new equipment

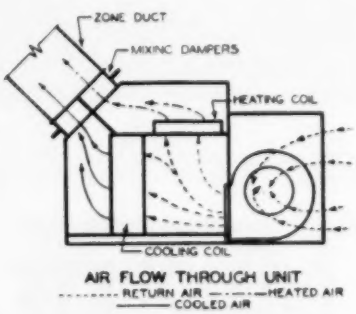
(Continued from page 28)

they detect the heat of the ingot at from 1 to 12 points and relay the information to electronic recording instruments. With this system, one operator can make the necessary adjustments without stopping operation.


HEATER UNCONTROLLED
HEATER WITH TEMP CONTROLLER ONLY
Control temperature
HEATER WITH TEMP CONTROLLER AND RATE-OF-RISE THERMOSWITCH
0 1 2 3 4 5 6 7 8 9 10 11 12
TIME IN MINUTES

Thermostat acts as safety control

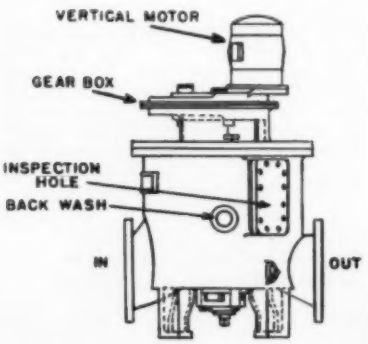
K37 Fenwal Inc. has developed a rate-of-rise thermostat designed to control rate of heating and prevent hazardous temperature overshoots in fast warm-up systems. When used in series with a temperature controller, the thermoswitch brings the system up to temperature from a "cold" start—at any rate desired—without overshoot and oscillation around the control temperature. It may also be used separately as a safety limit switch to shut down a process or machine where excessive rates of temperature rise indicate an abnormal, hazardous condition, and is adjustable to control any heating rate between 10 and 100 deg per minute. Used in any ambient temperature between -100 and 550 F, the unit's electrical rating is 5 amps at 115 v ac, or 2 amps at 28 v dc.



Single unit air conditioners provide heating and cooling

K38 Multi-zone air conditioners providing both heating and cooling from a single unit to a number of separate areas, each with individual temperature control, have been introduced by the United States Air Conditioning Corp. The equipment is particularly well adapted to multi-room building

applications where independent and variable cooling and heating loads are encountered. Known as type B, they are designed to serve 12 to 16 zones and have a capacity of 7500 to 18,000 cfm.

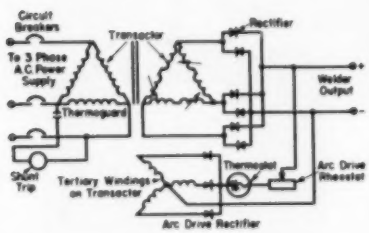


Self cleaning strainer used for corrosive materials

K39 S. P. Kinney Engineers, Inc. have designed a low-cost automatic self-cleaning strainer to remove fine suspended particles from raw or process water. The units, made in 2 to 36 in. pipe line sizes, are constructed of non-corrosive materials which also can strain sea water, ammoniacal liquor, gasoline, oil, and other liquids. Straining media are easily interchanged through an extra large inspection opening, and are constructed of stainless steel, bronze, or porcelain.

TO REQUEST ADDITIONAL DATA

Circle "key" numbers on reply card between pages 34 and 35. Your requests will be handled promptly.



Size and weight reduced in arc welder

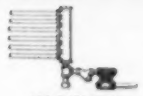
K40 Reductions in size and weight, and increases in ease of maintenance, and user, operator convenience are added advantages of the Westinghouse Electric Corp.'s selenium rectifier d-c arc welder. Overload protection guards the welder from damage when it is operated at an excessive duty cycle or without the ventilating fan. Arc drive control eliminates arc short

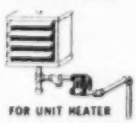
(Continued on page 32)

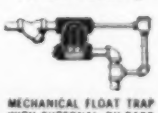
NEW HOFFMAN

FLOAT and FLOAT and THERMOSTATIC TRAPS

FEATURING:
1 Integral thermostatic air by-pass consisting of thermal element, seat, and cage—factory set and sealed.
2 Valve lever and seat assembly constructed of brass stampings. Spherical steel copper clad float.
3 Stainless steel valve pin and valve seat—valve pin adjustable for positive seating.
4 All working parts mounted on the cover for easy accessibility—no pipe connections to break.
LOW MAINTENANCE COST
Float and Thermostatic Traps with cover construction so designed that all working parts of the trap are readily accessible. Once installed there is no necessity for the breaking of any pipe connection as all cleaning and repairing can be made by removing the cover of the trap.


FOR PIPE COILS


FOR UNIT HEATER


MECHANICAL FLOAT TRAP WITH EXTERNAL BY-PASS

Again Hoffman provides industry with an improved product, refined to *function more effectively and economically in removing condensate.*

Hoffman engineers thus anticipate industrial steam heating trends that demand less maintenance and operating costs.

The new 50 Series Float and Thermostatic Trap has an integral thermostatic air by-pass consisting of thermal element, seat, and cage, factory set and sealed assuring dependable service and easy maintenance.

The same fine Hoffman quality and precision workmanship prevails in these traps as in the other Hoffman heating specialties. The valve lever and seat assembly is constructed of durable brass stampings. The spherical float is copper clad steel. The valve pin, adjustable for positive seating, and the valve seat are made of stainless steel. Sizes are available from ¼" to 2"—pressure requirements of ½ lb. to 125 lb.

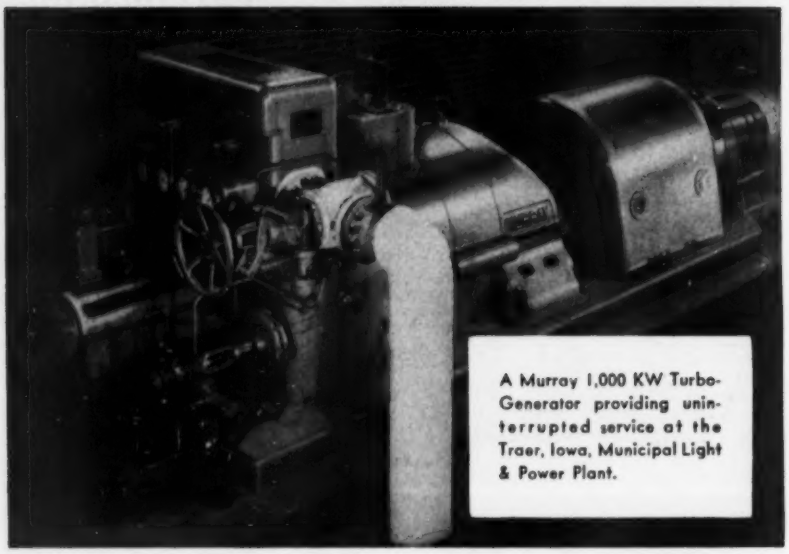
If you are planning to install low, medium or high pressure Float or Float and Thermostatic Traps, it will pay you to ask for Hoffman's new illustrated catalog sheet, available upon request.

HOFFMAN SPECIALTY MFG. CORP., 1001 York Street, Indianapolis 7, Indiana

Makers of Valves, Traps, Hot Water Heating Systems, Vacuum and Condensate Pumps

Circle 519 on Reply Card for more data

Murray Turbines



A Murray 1,000 KW Turbo-Generator providing uninterrupted service at the Traer, Iowa, Municipal Light & Power Plant.

● A typical, modern, small public utility is the Municipal Light and Power Plant at Traer, Iowa. This plant supplies water, steam heat and electric power to the community and surrounding countryside. The Murray turbo-generator pictured above carries the full electrical load of the plant and supplies the steam for heating by automatic extraction at 10# gauge pressure.

The simplified design and rugged construction of this and all MURRAY turbines particularly adapt them to this or any other drive where long life, reliability and low operating costs are a MUST.

MURRAY IRON WORKS COMPANY
BURLINGTON, IOWA

BUILDERS OF STEAM POWER EQUIPMENT FOR THREE QUARTERS OF A CENTURY

Circle 520 on Reply Card for more data

new equipment

(Continued from page 31)

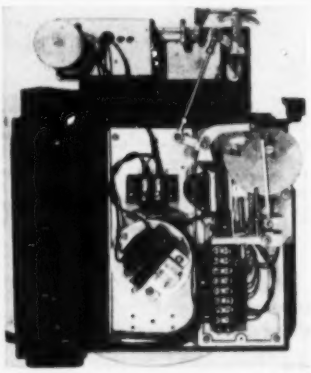
outs during welding applications requiring a short arc. Although the three standard sizes are 200, 300, and 400 amp, Duplex models are available in 300 to 600 and 400 to 800 amp ratings. Recovery time from rated load to short circuit for this welder is about 0.007 sec, over 40 times as fast as the average motor-generator type d-c welder.

Non-metallic rust inhibitor is developed as oil additive

K41 A rust inhibiting oil additive, believed to offer more complete protection of ferrous surfaces than has been possible heretofore with other non-metallic inhibitors, is available in commercial quantities from Atlas Powder Co. Uses include the protection of diesel and gasoline engines, turbines, pipelines, and ferrous tools or components in production stages. In internal combustion engines particularly, this material is said to provide freedom from pre-ignition and other undesirable effects of ashy residue encountered with sulfonic inhibitors containing the salts of such metals as sodium, calcium, or barium. Samples and literature are available.

TO REQUEST ADDITIONAL DATA

Circle "key" numbers on reply card between pages 34 and 35. Your requests will be handled promptly.



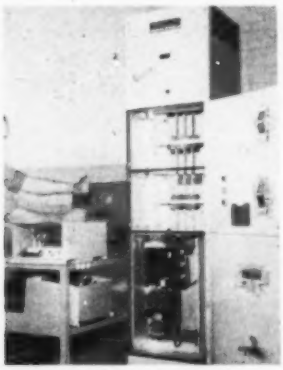
Flow meter designed with metallic bellows transmitters

K42 An electronic type flow meter which makes use of mercuryless bellows transmitters has been designed by The Hays Corp. It is available in several different models for indicating, recording, and with a continuous type mechanical integrator or combinations thereof for measurement

of the flow of fluids such as steam, water, and other fluids and gases. Records of air flow for boiler operation and pressures and temperatures can be combined in the same unit. Metallic bellows type transmitters used with the meter are for differentials of from 20 to 750 in. water with standard static operating pressure of 1500 psig. Higher pressure ratings can be supplied if required. Literature is available.

Dust collector improved

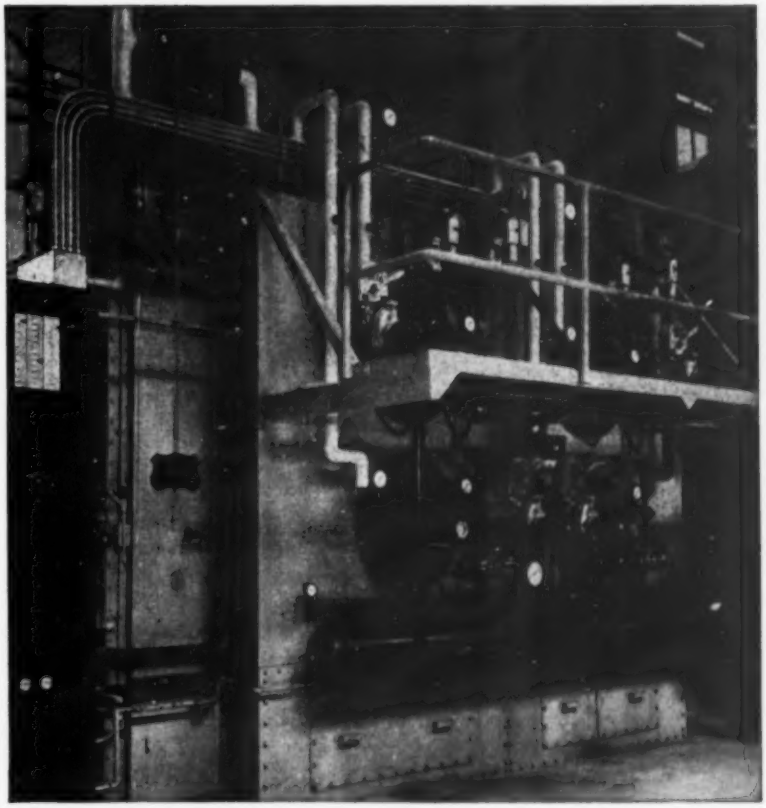
K43 Design 4, Type N Roto-Clone dust collector, an improved hydro-static precipitator which separates the dust from the air by means of an S-shaped water curtain, has been announced by the American Air Filter Co. Three basic models, identical in operating principle but differing in hopper design and means of sludge removal, provide manual cleanout, continuous drain, and sludge ejection by flight conveyors. Improved features include: non-plugging water entrainment separators; heavier sludge ejector mechanism; wider range of sizes and capacities, 1000 cfm to 48,000 cfm; and sectional construction to permit field conversion. Bulletin is available.



Aluminum control center features corrosion resistance

K44 An all-aluminum control center —65 percent lighter than its steel and copper counterpart—has been developed by Westinghouse Electric Corp. Individual units are removed easily for servicing by a 90 deg turn on 2 quick fasteners. The center was designed for industries in which cleanliness is important and for those where corrosive atmospheres are a problem.

ENCO GAS-OIL BURNERS for LOWER Fuel Costs



The Enco gas-oil burners in this boiler will burn oil or gas—or both. The change-over is simple and is made according to the availability or cost of these fuels. Thus the plant can avoid a shut-down when one fuel cannot be obtained, or can switch from one fuel to the other according to the relative prices or the cost per btu. Combustion is uniform with either fuel or both, even though steam demands swing sharply—another fuel-saving, money-saving feature.
Other Enco burners offer similar economies for boilers of practically all sizes and types.

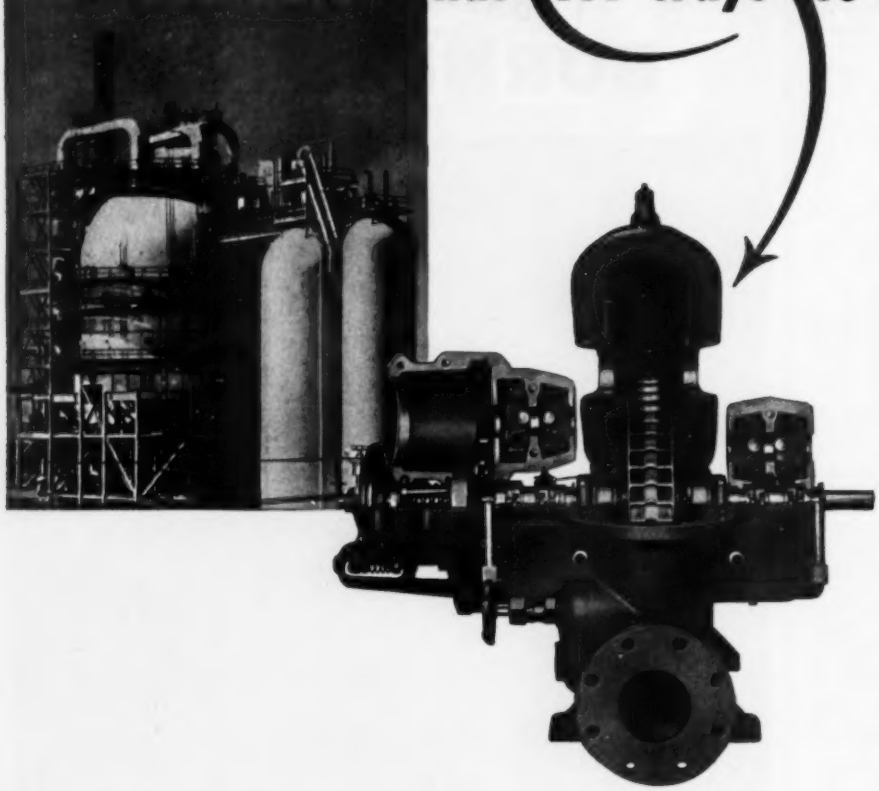
We invite inquiries on all burner problems — including those involving a wide range of capacities with a demand for complete atomization. We have had 35 years of experience in this field.

SC 491

THE ENGINEER COMPANY
75 WEST STREET, NEW YORK 6, N. Y.
IN CANADA: ROCK UTILITIES LTD., 80 JEAN TALON ST. W., MONTREAL, P. Q.

Circle 521 on Reply Card for more data

REFINERY has 101 ways to save money



When the yearly cost of replacement parts for 101 steam turbines averages *only 1.6% of the initial investment*, you are saving money . . . and plenty of it.

This amazing record was established by Terry turbines at a large refinery on the Atlantic coast. The percentage figure was determined by means of an accurate tabulation of the cost of replacement parts required over a two-year period.

These 101 Terry machines provide a good cross section of the various types of small and medium-size turbines made by the company. Ranging in size from 10 to 1200 horsepower, they include single and multistage axial flow designs as well as the famous Terry solid-wheel turbine.

Such outstanding performance records are not at all unusual for Terry turbines. The thousands and thousands of these machines installed in refineries throughout the world provide an accurate yardstick for measuring turbine reliability.

Send for illustrated bulletins. No. S-116 describes the many advantages of the Terry solid-wheel turbine. For multi-stage turbines, ask for a copy of Bulletin S-146.

TERRY

THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.

TT-1194

Circle 522 on Reply Card for more data

letters

. . . from readers

Fluorine in Water

Gentlemen:

I have read with interest the brief article entitled "Storage Batteries Unharmed by Fluorine Treated Water," which appeared on page 71 of the August issue of INDUSTRY AND POWER.

The article makes the following incorrect statement: "Drinking water treated with fluorine normally contains two parts of fluorine per million parts of water."

The correct fluoride dosage for a public water supply to prevent dental decay is 1 part per million. This figure is universally recommended by state and national health agencies and by professional societies interested in fluoridation. In the interest of keeping the record straight on the vitally important fluoridation program, this error should be corrected for your readers.

Clarence I. Sterling, Jr.
Chief Sanitary Engineer
The Commonwealth of Massachusetts
Boston, Massachusetts

● *We are happy to make this correction.*

Car Shakers

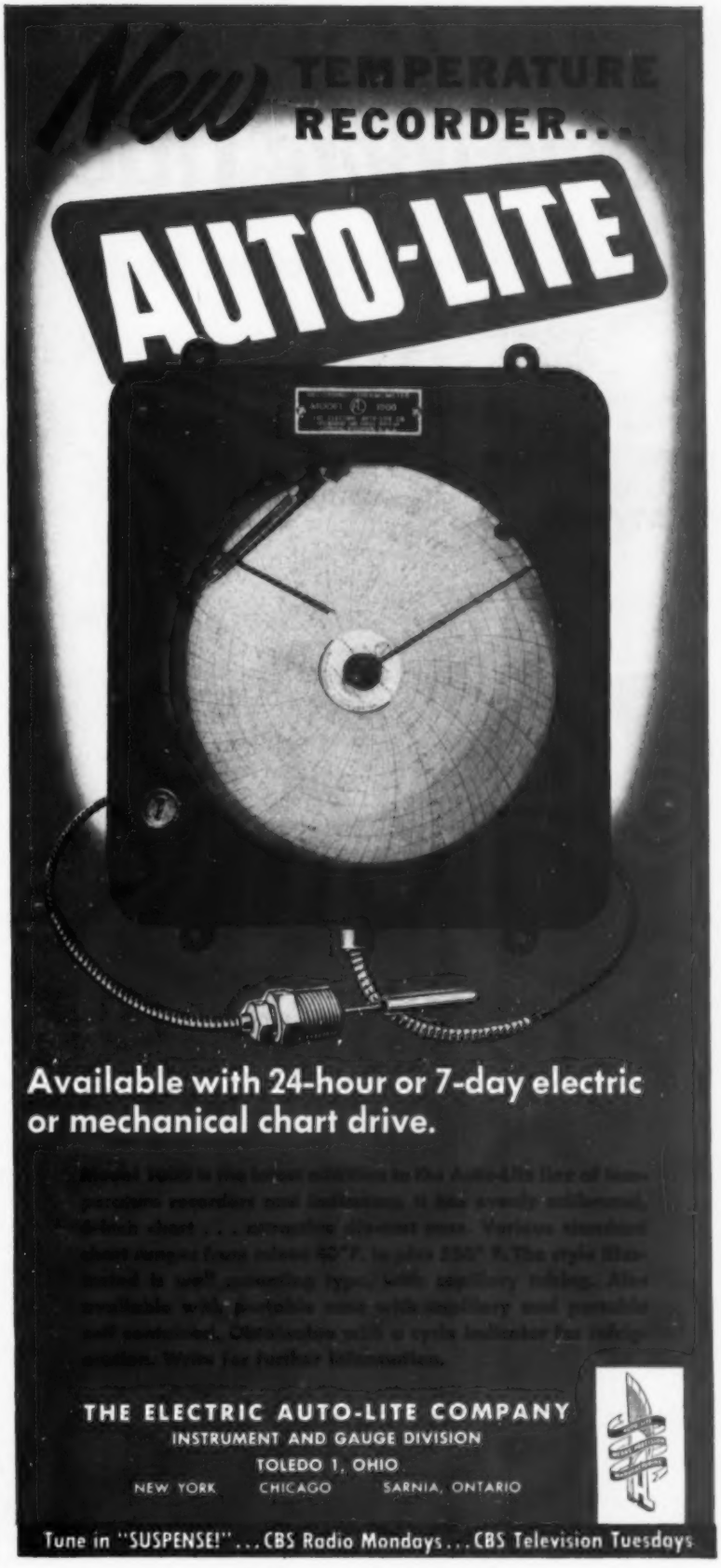
Gentlemen:

Our attention has been directed to the article "Hopper Cars Take a Good Shaking," which appeared on pages 89-91, inclusive, of the June INDUSTRY AND POWER.

We wish to take this opportunity of thanking you for including the picture of our car shakeout on page 89, and in this connection would like to mention that the accompanying caption, "Testing a new car shaker—etc.", developed varying inferences among members of our organization. The caption was true in 1945, as the picture depicts our first installation at the Carbon Fuel Company.

Since that time, the Robins car shakeout in question has unloaded 3,207,708 tons of coal, which means approximately 65,000 railroad cars. The attached tear sheet of a recent advertisement, which was proofread by the management of Carbon Fuel, presents the case history of this installation.

In addition, we have since manufactured and sold an additional 925 car shakeouts, which indicates our units have received wide acceptance


New TEMPERATURE RECORDER...
AUTO-LITE
Available with 24-hour or 7-day electric or mechanical chart drive.
THE ELECTRIC AUTO-LITE COMPANY
INSTRUMENT AND GAUGE DIVISION
TOLEDO 1, OHIO
NEW YORK CHICAGO SARNIA, ONTARIO
Tune in "SUSPENSE!"...CBS Radio Mondays...CBS Television Tuesdays

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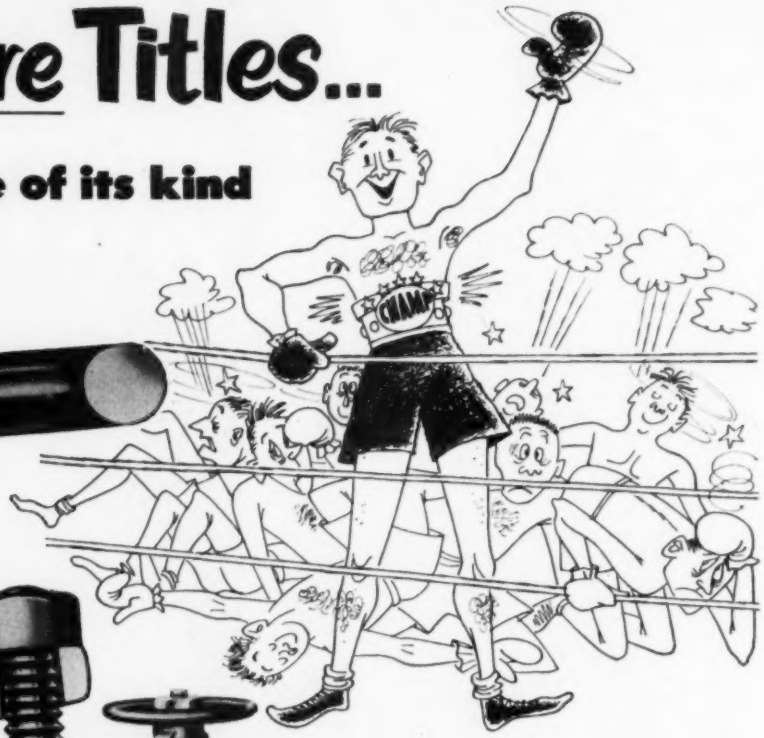
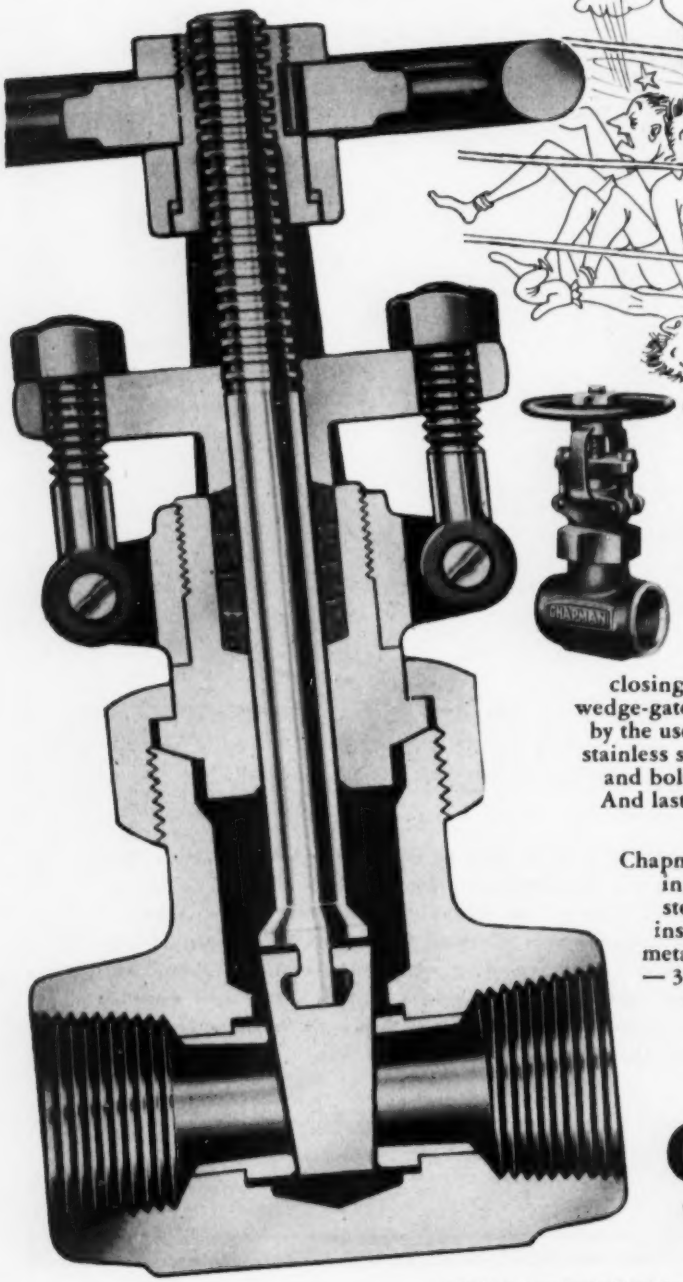
CHAPMAN LIST 960

Holds More Titles...

than any valve of its kind





Yes, here's the champ of all small forged steel gate valves! It has licked more different jobs than you can shake a stick at . . . and stays in there fighting with all the *extra stamina* you get in *every* Chapman Valve.

Here are the reasons why: Extra protection against even unusual stress when opening and closing the valve is provided by extra-strong stem-and-wedge-gate connection. Repairs and replacements are cut by the use of super-hardened seat rings and gate faces of stainless steel. Forged body and yoke are longer-lived . . . and bolted follower has no threads on yoke to corrode. And lastly, gate faces won't seize or gall because they're *Malcomized* (Chapman patent) to 800 Brinell.

Chapman List 960 Forged Steel Gate Valves are made in sizes from ½" to 2" inclusive . . . with rising stem with yoke (shown) or with rising stem with inside screw. Bonnet joints are either gasketed or metal to metal. Pressure range: 2,000 lb. at 100° F. — 380 lb. at 1,000° F. For higher pressures, specify List 990. And for full details on List 960, send today for your copy of Catalog 10.

THE CHAPMAN VALVE MFG. CO.

INDIAN ORCHARD, MASS.

Circle 524 on Reply Card for more data

in the steel, coal, chemical, railroad, aggregate, and allied industries.

J. R. McGuire
Car Shakeout Sales
and Development
Hewitt-Robins, Incorporated
Passaic, New Jersey

Reverse on Reversed Washer

Gentlemen:

The article "Reversed Washer Saves Water" for City Bank-Farmers Trust Building in the August issue of your magazine has just come to my attention. The general nature of the article and the incomplete specific information (and performance) given is unfair to the uninformed reader. A flow diagram would have helped the material and/or a dimensioned plan drawing of the installation.

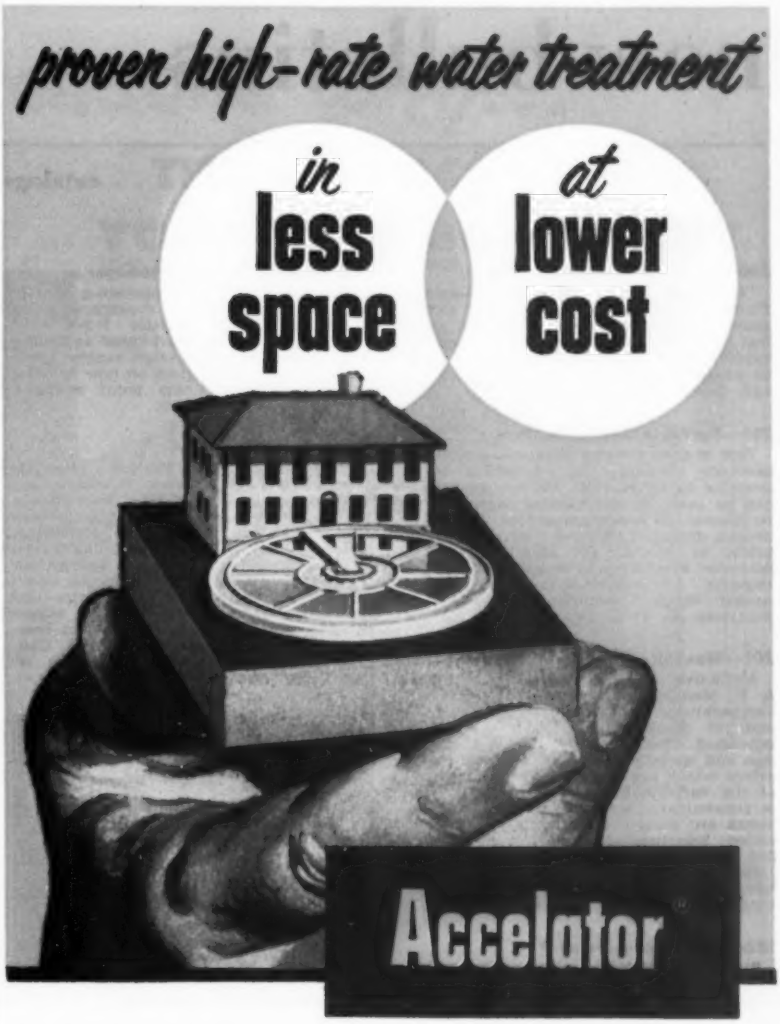
For instance, the article states "The makeup water is approximately 1.6 percent which is considerably better than the average cooling tower located outdoors." What cooling range is this based upon? For a cooling tower, the makeup is about 1 percent per 10 F water cooling range, or 1.6 percent if the cooling range of the water were 16 F.

The author has not mentioned the gpm circulated or the water temperatures (hot and cold). We can and have installed cooling towers indoors, contrary to the author's intimation in his opening sentence; however, a 400-ton installation should be put outdoors.

The cost of a "fire-proof" cooling tower (as required in New York City), 400-ton capacity, would be about $60.00 per ton including complete installation, as compared to your author's total cost of $280.00 per ton. To have put an oversize tower on the 12th or 23rd floors (outdoors) would have been an acceptable alternate. Appearance could be improved by suitable treatment of the outside walls of the tower; also with an oversize unit, the drift and noise would be negligible.

In fact, the reversed washer is an indoor spray-type cooling tower with space requirements several times that of a comparable mechanical draft cooling tower. This valuable indoor space could be rented for offices, and the cooling done by a cooling tower located in an outdoor (non-used) area. The overall economics of this reversed washer installation has evidently been ignored by (of all people) the bankers.

Howard E. Degler
The Marley Company



The Accelator combines – in a single unit – mixing, coagulation and solids separation. It occupies a fraction of the space required by other types of conventional plants and greatly reduces installation costs. Softening, clarification and stabilization plus highly efficient algae and bacteria removal are obtained at the highest flow rates because of the Accelator's slurry recirculation and dynamic separation. For full details send for your copy of the informative 28-page Accelator bulletin.

Use coupon below

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INFILCO INC., P.O. Box 5033
Tucson, Arizona

Please send to my attention _____ copies of Accelator Bulletin 1825-W.

Name _____
Title _____
Firm _____
Address _____
City _____ State _____

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new bulletins

. . . catalogs from leading manufacturers

200—Flame Failure Explosions

"Guarding Your Properties Against Flame Failure Explosions," booklet CP21, shows how to determine whether your fuel burner is adequately protected against explosion and briefly describes equipment to provide complete protection. Combustion Control Corp.

201—Portable Space Heaters

This 38-page booklet emphasizes the importance of safety in connection with portable space heaters. Heaters described can be used for pre-heating engines and equipment on construction jobs, in warehouses, drying stock-piled concrete blocks, brick, or lumber for ship-building—or wherever emergency or temporary work is required. Air is directed to the area to be heated through flexible canvas ducts. American Air Filter Co.

202—Manually-Operated Indicators

Attractive 22-page booklet entitled "L & N Manually-Operated Indicators for Temperature, Electrolytic Conductivity and pH Measurements," has just been published. This booklet describes the design and operating accuracy of these indicators which are direct reading in terms of the variable being measured. Catalog is conveniently arranged so that instruments are described according to application. Selection of equipment is simplified by listing in tabular form all specifications for indicators and accessories. Also contains typical installation photos. Catalog ND42. Leeds & Northrup Co.

203—Speed Measurement

Bulletin 31-P8 deals with measurement of speed by resonance or vibration and tells how a series of tuned steel reeds can indicate speed more accurately than most mechanical tachometers and speed indicators. This equipment, which has no moving parts and negligible maintenance, is said to operate for years without loss of accuracy and at very low cost. James G. Biddle Co.

204—Miniature Indicator

Construction, installation, and design features of a remote miniature indicator are described in a new 12-page bulletin 55-10. Photographs show construction of bellows spring assembly and details of other components. The incorporation of various types of warning devices in the instrument is also explained. Space requirements for panel mounting are given as well as specifications for range of operating air pressures, scale types, graphic color guides or alarms, accuracy, and alarm switches. Fischer & Porter Co.

205—Annunciators

Self-policing annunciator systems for industry are described in 6-page bulletin M-I-GP-SM. Operation and advantages of the three components of such a system are discussed. A typical wiring diagram and dimensions drawing are included in addition to a table of standard signal sequences. SCAM Instrument Co.

206—Recording Potentiometer

Cutaway drawings of operating sections stressing simplicity of construction are given in 14-page booklet P-2-A. The method of changing chart speed and range is explained. Standard chart ranges, specifications, and information on how to order are listed for the single point recorder. Weston Instrument Corp.

Electronic Measuring

"Instruments for Modern Measurements," 34-page brochure, illustrates and describes over 37 different instruments. Each unit is indexed according to the type of job done, such as pyhsical, resistance-welding, textile, and electro-acoustical measurements, and ultrasonic energy applications. This should be of special interest to research engineers, methods and production engineers, and factory superintendents. **Please send requests on company letterhead directly to Brush Electronics Co., 3405 Perkins, Cleveland 14, Ohio, Sales Promotion Dept. IP.**

208—Pneumatic Controllers

This 4-page catalog describes field-mounted Pneumatrol pneumatic controllers. It gives a working sketch of the motion of balance mechanism and includes diagrams of 3-line and 4-line field-mounted systems. Catalog No. 53-11. Fischer & Porter Co.

209—Specific Gravity of Gas

This bulletin, 14-A-12, describes gas specific gravity measurement and control systems using the combination of Ranarex and Fischer & Porter instruments. It covers components of the system, details several applications, lists general specifications for specific gravity ranges, and gives a breakdown of the equipment required for either transmitting—recording or transmitting—controlling installations. Fischer & Porter Co.

210—Piping and Pressure Vessels

A new company publication designed to give brief descriptions of recent technical publications and new standards that will be of interest to engineers working with piping and pressure vessels, it will also contain a digest of recent boiler code and pressure pipe code and other data of interest to engineers working in this field. Taylor Forge & Pipe Works.

211—Power Cables

"Rubber-Insulated High Voltage Power Cables up to 35,000 Volts," 128-page handbook, contains complete technical information, including current carrying capacity tables; aluminum conductor conversion factors; formulas for calculating the effects of shielding; dimensional data on bare conductor cable constructions; installation recommendations; and methods for determining conduit size, fill and area, and bending radii and pulling tensions. Of particular interest are 29 pages of detailed drawings and instructions for splicing and terminating. The Okonite Co.

Refrigeration Equipment

Refrigeration equipment, its installation, maintenance, and servicing, when used in conjunction with air conditioning systems, is the subject of revised 125-page manual M361-5. It begins with a discussion of refrigerants and the refrigeration cycle and goes on to give detailed information concerning all the component parts of such systems. Included are new chapters on piping and controls and a revised chapter on service operation. The service analysis chart has also been revised. **Price $1.50. Please send requests directly to The Trane Co., Dept. IP, La-Crosse, Wis.**

213—Unit Heaters

A wide scope of commercial, industrial, and institutional heating installations are described in 12-page bulletin No. 14. This publication is designed to assist a designer in solving heating problems by displaying solutions where comfort, economy, and floor saving have been accomplished. It also points out the ease with which unit heater systems can be rearranged. Industrial Heater Association.

214—Uses of Aluminum

"Alcoa Aluminum in the Process Industries," 8-page booklet AD278, tells of the uses of aluminum in such industries as plastics, soaps, cosmetics, drug products, sulfur, petroleum, and chemicals. Economic advantages of aluminum, and tables covering materials handled safely with aluminum, composition and properties of aluminum alloys, and other engineering information are included. Photographs illustrate uses of these products in industry. Folder AD277 discusses aluminas and fluorides. Aluminum Co. of America.

215—Rubber Bearings

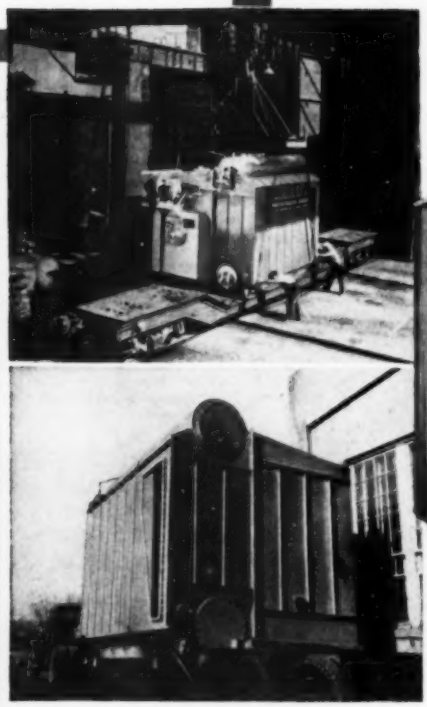
A new 34-page catalog describes the uses and advantages of rubber bearings when applied to industrial equipment. Catalog contains engineering data of interest to plant engineers and tells how these bearings are applied to pumps, agitators, and similar equipment where bearings can be lubricated with water or by the liquid handled in the equipment. Bearings are available in complete range of sizes and are made of rubber compounded to resist wear and heat. B. F. Goodrich Co.

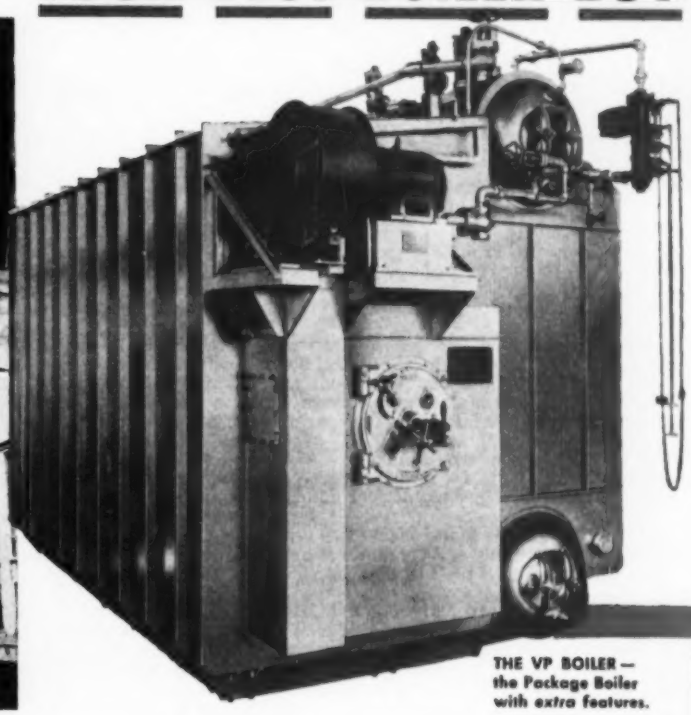
(Continued on page 40)

NOTE — Each new bulletin item has a key number for your convenience in asking for a free, personal copy. Circle key numbers on reply card between pages 106 & 107.

4 reasons why...

THE VP PACKAGE IS YOUR BEST BOILER BUY





THE VP BOILER — the Package Boiler with *extra* features.

1 Fully Water-Cooled Furnace — More cooling area per cubic foot of furnace volume than any other boiler of the VP's size and type. In all but the three smallest sizes, the VP Boiler has water-cooled walls on *all six sides* — including the burner wall. Assures rapid, efficient heat absorption. Minimizes furnace maintenance.

2 Larger Lower Drum — The 30 in. diameter lower drum permits a simple, symmetrical tube arrangement . . . provides easy access for washing down or inspection . . . its greater water storage capacity facilitates the handling of fluctuating loads.

3 Simple Baffle Arrangement — Minimum changes in direction — no baffle at all in convection bank in larger VP Boilers. This means lower draft loss . . . simplified soot blowing . . . elimination of dead pockets, thus, maximum heat pick-up. In the intermediate sizes, a water-cooled baffle assures minimum maintenance.

4 Centrifugal Fan — This more efficient type of fan operates at lower speed than other types and is quiet in operation. In fact, its average noise level is less than half that of typical high-speed blowers used in most package boilers.

These four *extra* features are yours *only* in the VP Boiler which is designed and manufactured by Combustion — maker of many of the world's largest boilers. These units are available in capacities ranging from 4,000 to 30,000 lb of steam per hr, and pressures up to 250 psi.

Complete details on the C-E Package Boiler, Type VP, are available to you. Send for your free copy of Bulletin VP-131. B-666A

C-E

COMBUSTION ENGINEERING, INC.

200 MADISON AVENUE, NEW YORK 16, N. Y.

Circle 526 on Reply Card for more data

when power fluctuations affect processes . . . you NEED SORENSEN AC line regulators

here's a case where installing a SORENSEN AC REGULATOR saves $$$ in an RF gluing process

Timber Structures, Inc., of Portland, Oregon, are the largest producers of engineered timber structures in the country. RF is used for pre-gluing scarf joints of lumber to be laminated into very large arches, and also for gluing the firm's "Timberib" barn rafters on a mass production basis. The RF presses were developed by Timber Structures, Inc., engineers.

Voltage to the four RF generators varied greatly due to constantly changing loads throughout the plant. The serious fluctuations necessitated the repair of 5% of total output and scrapping of another 5% as total loss. Unsuccessful attempts were made to remedy the condition through the use of additional and separate service transformers.

The local Sorensen representative surveyed the situation and recommended installation of a 15KVA Sorensen Regulator. The result—complete elimination of product loss or damage through erratic voltage.

The installation was made nearly five years ago. Since then — complete satisfaction! The only service required by the Sorensen Regulator during this period has been the installation of one set of new tubes.

We know that a great many manufacturing difficulties are caused by line fluctuations, most of which could be eliminated quickly and economically by Sorensen AC Regulators. Find out more about this, at no obligation. from your Sorensen representative — write us for his address. Sorensen & Co., Inc., 375 Fairfield Avenue, Stamford, Conn.

SORENSEN

SORENSEN AND COMPANY 375 FAIRFIELD AVENUE, STAMFORD, CONN.

Circle 527 on Reply Card for more data

new bulletins

(Continued from page 38)

216—Gate Valves

Two illustrated bulletins describe a line of 150 and 200 lb bronze gate valves. Complete with dimensions, these bulletins describe the advantages of flange and screw gate valves equipped with either double or solid nickel-alloy wedge disc in rising stem design and with a single wedge disc in non-rising stem types. Valves in both pressure classes are available with Stemalloy stems and Non-Slip handwheels featured exclusively on this manufacturer's valve. Lunkenheimer Co.

217—Centrifugal Blowers

Two-color, 32-page bulletin B-6 presents information on types of centrifugal blowers and exhausters for handling air or gas. Typical applications are illustrated to indicate wide variety of use. Performance data is given for air blowers and exhausters with heavy-duty cast iron housings. Technical data is included on agitation of liquids, air for combustion, air for foundry cupolas, ice making, vacuum cleaning, and pneumatic conveying. Considerable other technical data is also available in this booklet. Lamson Corp.

218—Fuel Oil Preparation

New packaged units designed to provide an efficient and economical means of straining, heating, and pumping Bunker "C" or other grades of fuel oil used in oil burners is described in bulletin 16-H. These units are widely used in power plants and boiler rooms of utilities, institutions, and factories. Duplex construction of these units insures dependable and uninterrupted service in that while one system of pump-heater-strainer is on the line, a second system is in a stand-by position ready to be put into use at any time. Schutte and Koerting Co.

219—Boiler Feed Control

New bulletin 1013 illustrates and describes new Type 3-L Boiler Feed Control. This is a three-influence instrument-type control for heavy duty boilers. The controls described make use of the Copes control valve and combine it with Taylor instruments. Copes-Vulcan Division, Continental Foundry & Machine Co.

220—Tubular Conveyors

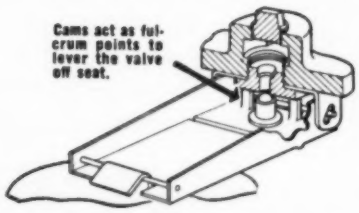
New bulletin shows engineering and mechanical details of tubular conveyors and illustrates the patented sealed-pin chain design which is said to increase chain life and reduce costs by keeping abrasive materials from reaching chain pins when the conveyor is in motion. Bulletin also describes various types of conveyor drive mechanisms, roller turns, and a vibrator which is used to discharge conveyed materials. These conveyors will

(Continued on page 42)

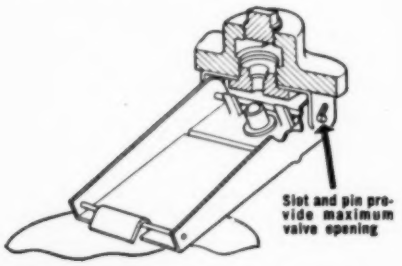
See how this NEW trap handles greater volume in less time

Yet it's small—gives you maximum capacity per dollar cost

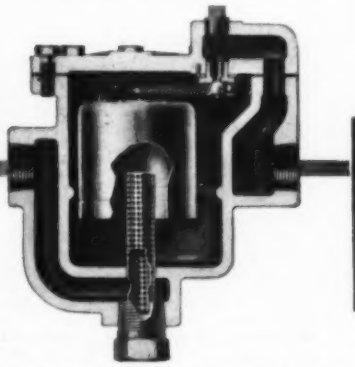
NEW SARCO
INVERTED BUCKET TRAP
with CAMLIFT valve mechanism

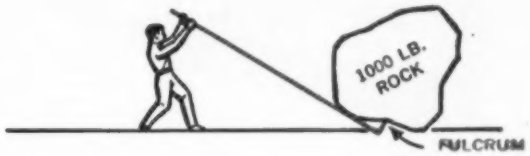


As bucket sinks CAMLIFT mechanism provides the powerful crowbar action needed to open large valve against steam pressure.

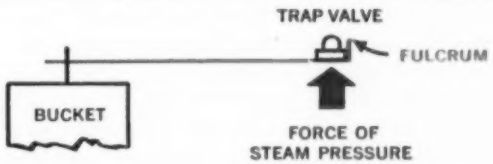


When steam pressure is overcome CAMLIFT mechanism drops to limit of slot, allowing rapid and free discharge of condensate.





MAN WITH CROWBAR MOVES 5 TIMES HIS WEIGHT



TRAP WITH CAMLIFT MECHANISM OPENS LARGE VALVE AGAINST MAXIMUM OPERATING PRESSURES

SARCO takes the principle of the fulcrum, incorporates it in its newly designed trap and gives you greater discharge with *no increase in trap size*. That means you get more for your steam trap dollar.

The Sarco *Camlift* valve mechanism makes this possible. It provides the powerful force needed to open the unusually large valve without a corresponding increase in trap size.

If you need a trap that's also rugged and simple in design, then we suggest you try this new Sarco Inverted Bucket Trap – in fact, we'd like to send you one for a free trial. We're confident you'll be convinced. Just clip the coupon and mail it in.

SARCO COMPANY, INC., Empire State Bldg., New York 1, N.Y.
Sarco Canada Ltd., Toronto 8, Ont.
Represented in Principal Cities

MAIL THIS COUPON TODAY FOR FREE TRIAL

Put this new inverted bucket trap to the test—see for yourself how to get more for your trap dollar.

Sarco Company, Inc., Empire State Bldg., New York 1, N.Y.

Gentlemen: Please send me a ½" Sarco Type B Bucket Trap for free trial. Maximum working pressure_____ psi; capacity_____ lbs/hr condensate.

NAME_____ TITLE_____

FIRM_____

ADDRESS_____

CITY_____ STATE_____

STEAM TRAPS • TEMPERATURE CONTROLS • STRAINERS • HEATING SPECIALTIES

Circle 528 on Reply Card for more data

AIRETOOL EQUIPMENT helps you REDUCE FUEL COSTS 150%!

A STARTLING STATEMENT, BUT TRUE

A 2" boiler tube with scale ⅛" thick, requires 150% additional fuel.* Scale also robs efficiency, reduces heat transfer and can cause irreparable tube damage.

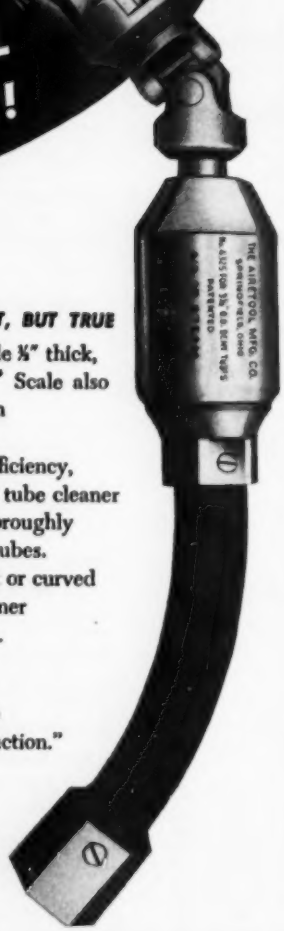
Why put up with reduced boiler tube efficiency, increased fuel costs, when there is an Airetool tube cleaner especially designed to quickly, safely and thoroughly remove scale, even from completely plugged tubes.

Airetool tube cleaners are made for straight or curved tubes . . . ½" to 24" I.D., in a variety of cleaner heads to meet all scale removal requirements.

IN FACT,

"There's an Airetool Tube Cleaner or Tube Expander for Every Type of Tubular Construction."

Write for bulletin, showing types and sizes.



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SCALE 1/50" THICK, 5% ADDITIONAL FUEL REQUIRED
SCALE 1/25" THICK, 10% ADDITIONAL FUEL REQUIRED
SCALE 1/16" THICK, 15% ADDITIONAL FUEL REQUIRED
SCALE 1/8" THICK, 30% ADDITIONAL FUEL REQUIRED
SCALE 1/4" THICK, 66% ADDITIONAL FUEL REQUIRED
SCALE 1/2" THICK, 150% ADDITIONAL FUEL REQUIRED

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Representatives in principal cities in U.S.A., Canada, Mexico, South America, England.

Circle 529 on Reply Card for more data

new bulletins

(Continued from page 38)

handle such materials as metal chips, sludges, carborundum dust, wet or dry chemicals, grains, pulverized coal, ashes, and filter cake. Hapman Conveyors, Inc.

221—Insulation Protection

This reference manual is designed to aid in application of coating and adhesive products used in the installation and surface protection of industrial insulations. Technical data, recommended uses, citation of appropriate specifications, and other important facts are given with the description of the product. Benjamin Foster Co.

222—Bus Duct

New 16-page bulletin BD-755 gives information on the features and uses of Plug-In BUStribution Duct. Bulletin also contains samples of layouts illustrating the way in which these fittings are used to simplify installation of electric duct. This class of duct is suited to factories, commercial buildings, and institutions. BullDog Electric Products Co.

TO REQUEST FREE BULLETINS

Insert "key" numbers on return post card found opposite page 106. Your requests will be handled promptly.

223—Vertical Turbine Fire Pumps

Bulletin W-450-B42 describes a line of vertical turbine fire pumps adapted to a variety of drives. Details of design features are presented along with excellent cross-sectional drawings to show pump design. Included is a table of performance data and outline dimensions with a listing of fittings required. Worthington Corp.

224—Condenser and Exchanger Tubes

A new handbook on condenser and heat exchanger tubes is designed to help the plant engineer decide which alloy will give the best service under his particular operating conditions. It presents alloy properties, discusses corrosion, and gives considerable engineering data on metals and tubes. A valuable handbook for plant engineers. Bridgeport Brass Co.

225—Oil Circuit Breakers

Construction features, ratings, dimensions, and weights of power oil circuit breakers designed for outdoor distribution service are given in bulletin OZ-23-250. Publication shows open front illustration of typical circuit breaker on which all important parts are numbered and fully described. Allis-Chalmers Mfg. Co.

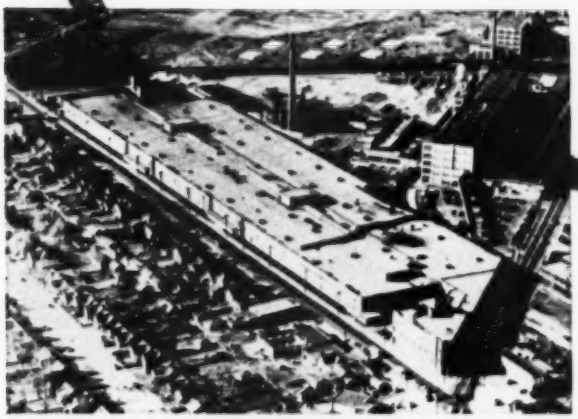
226—Copying Machines

Six-page bulletin describes portable copying machine used to make copies of letters, requisitions, graphs, invoices, tax forms, and all other such printed or written material. The making of a print requires only forty seconds and the small, portable machine can be plugged into any 110 v a-c or d-c outlet. F. G. Ludwig, Inc.

(Continued on page 107)

7 DETROIT STOKERS

in two *Eli Lilly and Company plants*

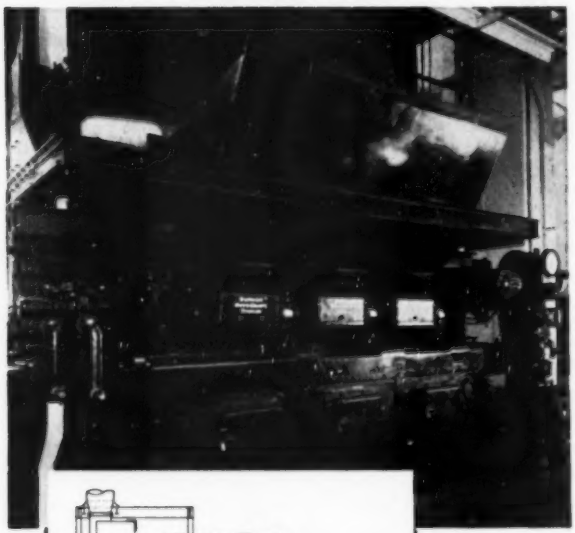


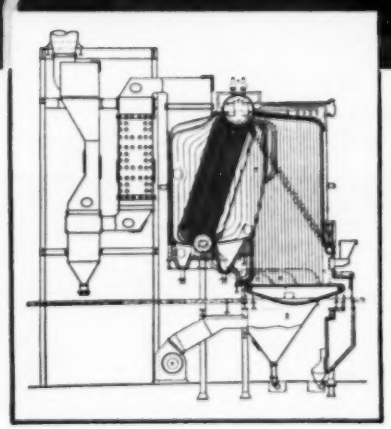
FOUR CONTRACTS

High efficiency with low maintenance—ability to handle rapidly fluctuating loads, and cleanliness are Detroit Stoker features that appealed to Eli Lilly and Company engineers.

Cleanliness—elimination of sources of possible contamination—is of paramount importance to plants making thousands of medicinal products having the highest reputation for purity.

At the left one of the two Detroit RotoGrate Stokers at the Lilly Indianapolis plant. Capacity each Babcock and Wilcox unit 75,000 pounds per hour. RotoGrates also are in service at their new Tippecanoe Laboratories, Lafayette, Indiana.





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DETROIT STOKER COMPANY

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District offices in Principal Cities • Works in Monroe, Mich.

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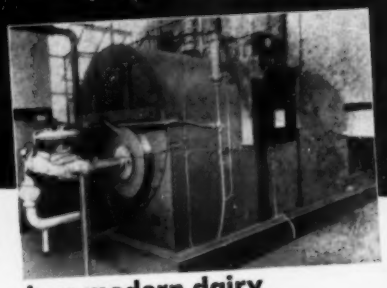
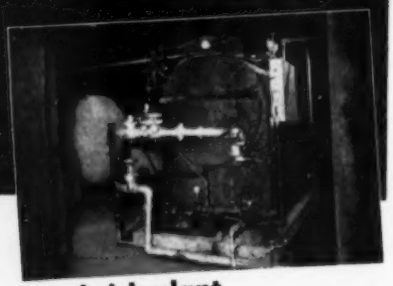
Dutton EconoTHERM EARNS OWNER PRAISE

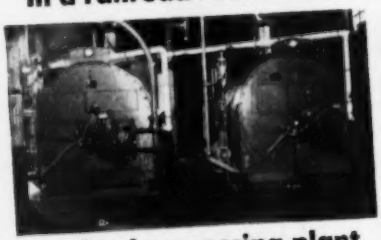
in a railroad roundhouse



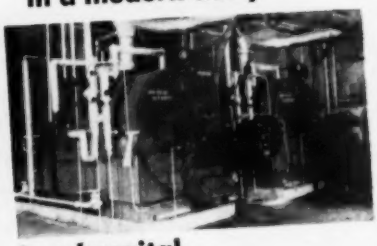
in a modern dairy



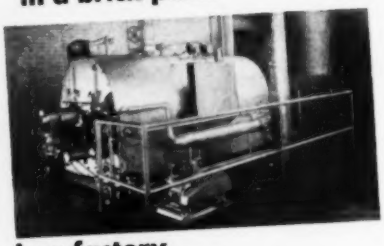
in a brick plant



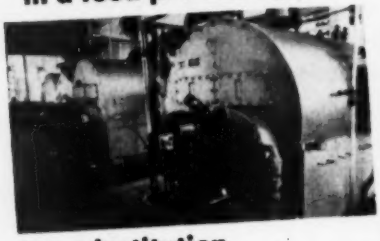
in a food processing plant



in a hospital

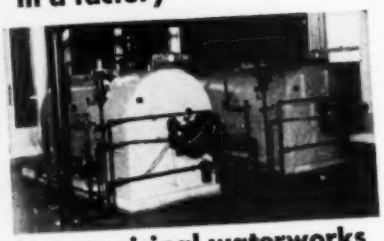


in a factory



in an institution

in a concrete plant



in a municipal waterworks

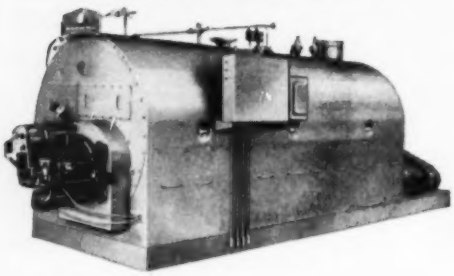
AND HERE'S WHY!

Verbally and by mail* owners have enthusiastically reported big savings in fuel, labor and space — often all three — thanks to EconoTHERM's efficient Off-center Firing, Rotary Combustion and Automatic Operation.

EconoTHERM gives quick steam with greater safety . . . saves fuel, labor and maintenance expense. Gas or oil fired, sizes are available to 250 H.P.

Get all the facts on the Dutton EconoTHERM's compact, modern packaged design and automatic operating features. See how it can satisfy your steam needs and save *you* money!

*Ask to see the letters!



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BOILER BUILDERS SINCE 1880

FOUR TYPES — SIZES FROM 5 to 250 h.p.

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Why is Demineralization being selected instead of Evaporators?

When should we use three or four-bed rather than two-bed Demineralizers? Mixed Bed?

Should we include a Decarbonator?

How do you figure Demineralizer operating costs?

Which Ion Exchange material should we specify?

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This new Cochrane Handbook answers these and many similar questions and contains flow diagrams and other illustrations giving you the benefit of Cochrane pioneering in this rapidly growing field. Request a copy on your letterhead.

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Hot Process Softeners • Deaerators • Dealkalizers • Demineralizers • Reactors • Continuous Blow-Off • Specialties • C-B Systems

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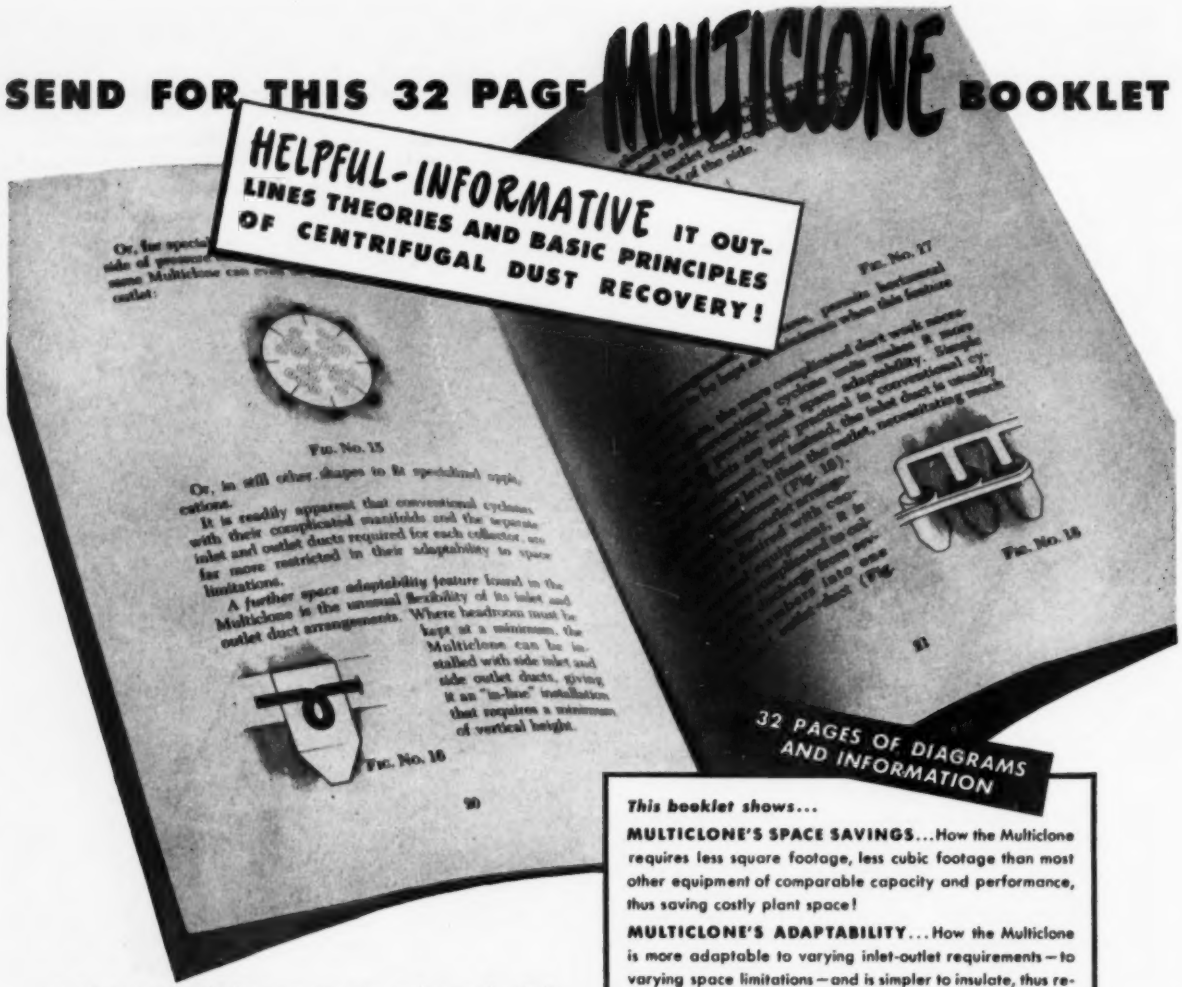
HELPFUL-INFORMATIVE IT OUTLINES THEORIES AND BASIC PRINCIPLES OF CENTRIFUGAL DUST RECOVERY!
Fig. No. 15
Fig. No. 16
Fig. No. 17
Fig. No. 18
32 PAGES OF DIAGRAMS AND INFORMATION

NO MATTER whether you are now using mechanical dust recovery equipment or are planning the installation of such equipment at some future date, here is a booklet that is full of helpful and valuable information on centrifugal dust recovery. It not only explains the basic methods and principles involved, but also shows the important differences between small and large diameter separating tubes, shows how to simplify your duct work and reduce installation costs, and outlines many other important factors to be considered in selecting mechanical dust recovery equipment.

In addition, this informative booklet illustrates and explains how MULTICLONE'S unique *vane* design is fundamentally different...how it makes possible greater compactness, simpler installation, high recovery of the small particles as well as the medium and coarser ones, and many other facts on MULTICLONE advanced design.

A limited supply of these booklets is available for free distribution to those interested in mechanical recovery equipment and methods. Write for your copy today.

This booklet shows...

MULTICLONE'S SPACE SAVINGS...How the Multiclone requires less square footage, less cubic footage than most other equipment of comparable capacity and performance, thus saving costly plant space!

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MULTICLONE'S EFFICIENCY...How Multiclone's multiple *small diameter* tubes, made possible by its exclusive vane design, give higher centrifugal forces and more complete cleansing of *all* suspended particles—even small ones of 10 microns and less!

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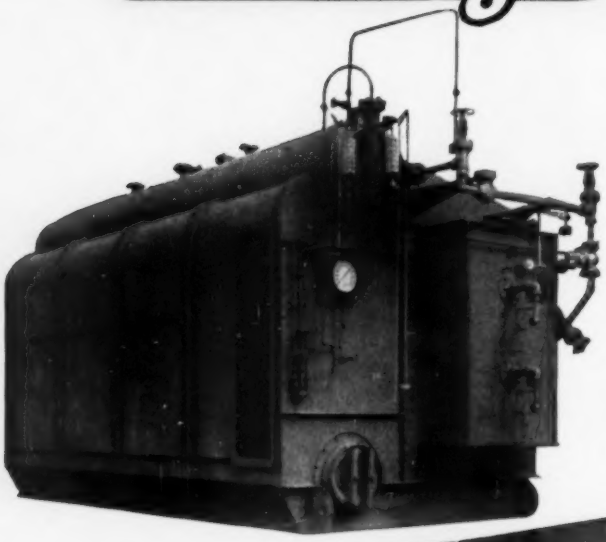
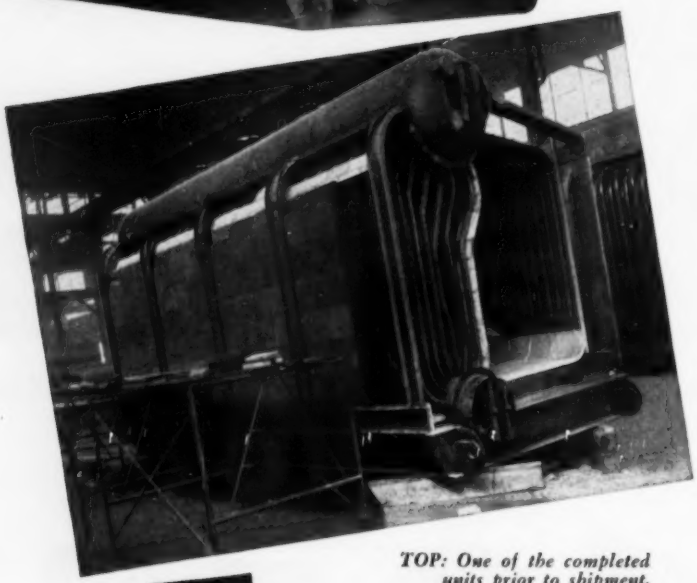
Vogt

Gas Fired
PACKAGE UNIT
Steam Generators
selected by
PHILLIPS CHEMICAL CO.
Pasadena, Texas Plant





TOP: One of the completed units prior to shipment.

BOTTOM: Shop erection view shows tile and block insulation in convection wall; also main baffle tile and furnace floor tile.

Principal Data, Each Unit

25,000 pounds steam per hour capacity. Induced draft type.

Fusion welded steam and water drums designed for 425 pound S.W.P.

Completely shop assembled and required only the piping and gas outlet connections to place them in operation.

Fully steel encased for outdoor installation on a simple foundation.

•

**Vogt Steam Generators are available in bent tube types and straight tube forged sectional header types for solid, liquid or gaseous fuels. Bulletins on request.*

HENRY VOGT MACHINE CO.
Louisville, Kentucky

BRANCH OFFICES: New York, Philadelphia, Chicago, Cleveland, St. Louis, Dallas, Charleston, W. Va.

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For power from steam DEALKALIZE WITH

AMBERLITE IRA-410

Without Acids or Degasifiers

Here are the facts about dealkalization with AMBERLITE IRA-410:

1. Alkalinity of water supplies for boiler feed and evaporator coolers may be conveniently controlled at low cost.
2. No acid-resistant or degasification equipment is necessary.
3. Because line pressure is not broken, pumping costs are eliminated.
4. Only low cost salt is required for regeneration—3 to 4 lb. per cubic foot of resin.
5. Combinations of the anion exchanger, AMBERLITE IRA-410, and the cation exchanger, AMBERLITE IR-120, permit simultaneous softening and dealkalization in a single column.

AMBERLITE is a trademark, Reg. U. S. Pat. Off. and in principal foreign countries.

CHEMICALS FOR INDUSTRY

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THE RESINOUS PRODUCTS DIVISION

Washington Square, Philadelphia 5, Pa.

Representatives in principal foreign countries

For more information about dealkalization with AMBERLITE IRA-410, write Dept. P-1 for complete literature. For bi-monthly reports on new developments in ion exchange, ask to receive AMBER-HI-LITES.

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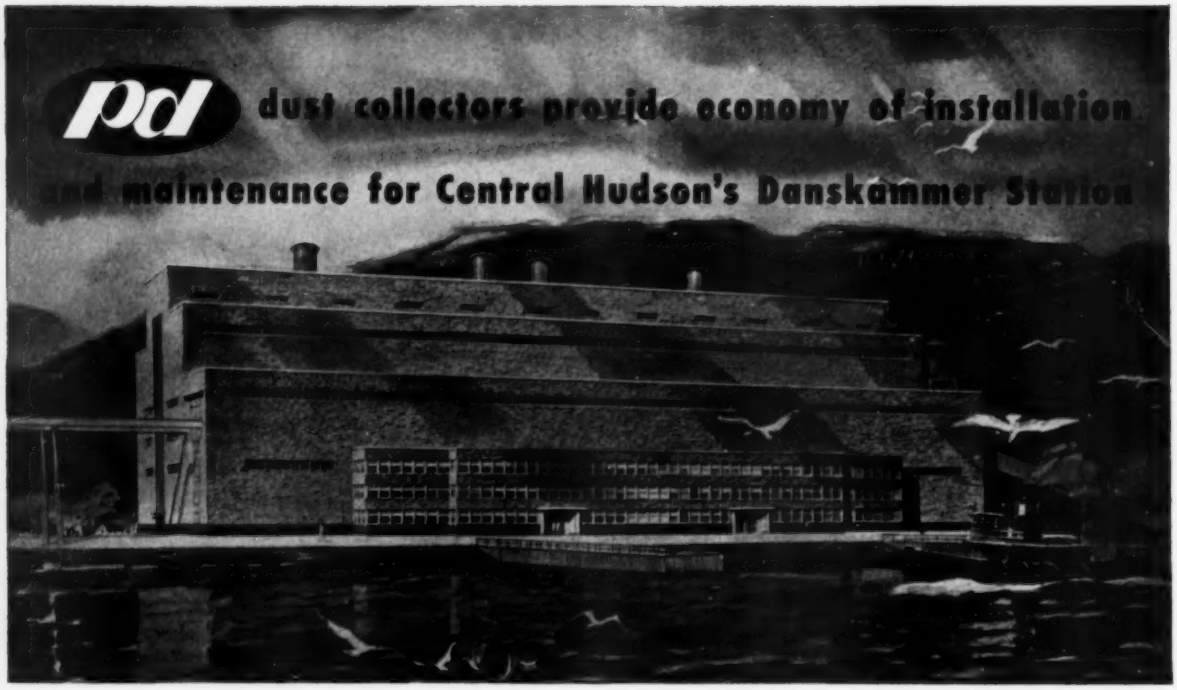


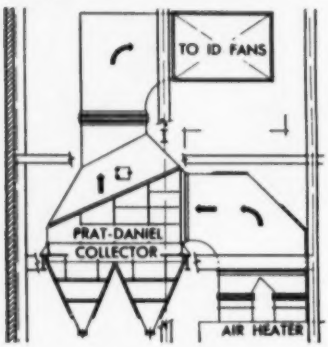
Exclusive Prat-Daniel Unibloc Construction Reduces Erection Costs

For assured efficiency, Prat-Daniel Dust Collectors were chosen to handle a 500,000 lbs. per hour continuous steam load on this installation.

Minimum space requirements were made possible by the small tube diameter. This feature also is responsible for the exceptional efficiency of these collectors. Greater centrifugal force is realized in a small diameter tube, increasing collection efficiency in the finer particle range below 20 microns.

Assembled in complete Unibloc sections at the factory, Prat-Daniel Collectors require less time for erection in the field. They are well known for their long life. Tubes examined in other installations after a period of ten years showed little or no signs of wear, even though subjected to continuous heavy dust loading.

Project Engineers for Prat-Daniel, The Thermix Corporation cooperated with Burns and Roe Inc. of New York, Consulting Engineers on the Danskammer Station. Thermix are specialists on dust collection . . . why not contact them for the answer to your problem.



Ask for the new P-D catalog 4P201

Catalog contains charts, nomographs, tables and efficiency curves on how to select a dust collector. You will want this valuable information for your files. Write for your copy today.

Project Engineers for Power Plant Division

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(Offices in 38 Principal Cities)

Canadian Affiliates: T. C. CHOWN, LTD., Montreal 25, Quebec; Toronto 5, Ontario

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SOUTH NORWALK, CONN.

POWER DIVISION: Tubular Dust Collectors, Forced Draft Fans, Air Preheaters, Induced Draft Fans, Fan Stacks

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Stopping rust with Rust-Oleum 769 Damp-Proof Red Primer
... for double protection use Rust-Oleum finish coatings
available in many colors, aluminum and white

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STOPS RUST!

Applied by brush, dip, or spray.

Just scrape and wirebrush to remove rust scale and loose particles . . . then brush Rust-Oleum 769 Damp-Proof Red Primer *directly over the sound rusted surface.* Chemical pre-cleaning and other costly preparations are *not* usually required. Rust-Oleum finish coats in many colors provide *double protection.* Specify Rust-Oleum . . . prompt delivery from Industrial Distributor stocks in principal cities.

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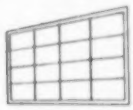
Such fields as Petroleum, Marine, Railroad, Mining, Agricultural, Steel, General Industry are but a few who rely upon Rust-Oleum. General weathering, heat, chemicals, salt water atmosphere, fumes, etc., are only a few of the conditions resisted by Rust-Oleum.

Water tanks, gas tanks, fuel tanks—Rust-Oleum protects your investment.

One truck, or a fleet of trucks, applied over rust, Rust-Oleum keeps them looking better . . . in service longer.



Metal sash and steel windows, roofs, gutters, fire escapes, railings—indoors and out need Rust-Oleum to stop rust.

Wire fence maintenance? Rust-Oleum's Extra-Long Nap Lamb's Wool Roller cuts re-coating costs up to 50% in some cases.

There is Only One Rust-Oleum

Rust-Oleum is an *exclusive formula* developed by a Master Mariner during more than 20 years battling actual rust conditions at sea. It incorporates a *specially-processed* fish oil vehicle that will *dry, is odor-free,* and is formulated in *many colors.* Be sure you specify genuine Rust-Oleum. Accept no substitute.

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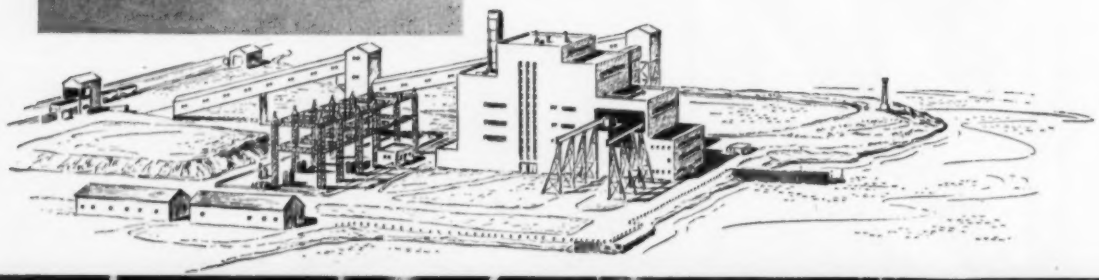
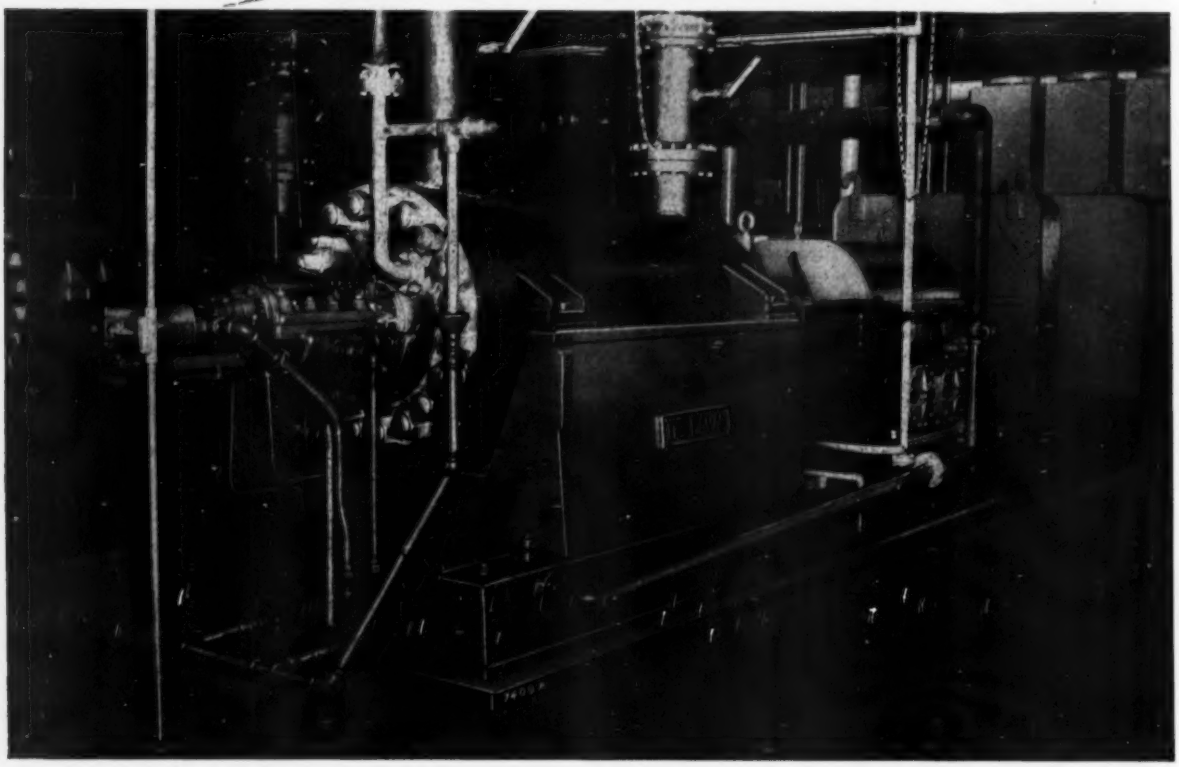
DE LAVAL

BARREL TYPE
BOILER FEED PUMPS

on the job at Danskammer Point





These two De Laval 11-stage barrel type boiler feed pumps are now helping to produce power for the Danskammer Point Steam Station of the Central Hudson Gas and Electric Corporation. Both pumps, one of which is used for standby service, are sized for full boiler load and will deliver 1,400 gpm of 326F water against 2,155 psig discharge pressure. Two more same size De Laval pumps have already been ordered for the second main unit of the Danskammer Station.

De Laval barrel type boiler feed pumps meet all the requirements of high pressure boiler feed service. They can be thrown on the line quickly without long preliminary warming up. They are not affected by sudden temperature changes. The distinctive De Laval design assures years of reliable service with minimum maintenance.

DE LAVAL *Boiler Feed Pumps*

DE LAVAL STEAM TURBINE COMPANY
85 Nottingham Way, Trenton 2, New Jersey

DL 179

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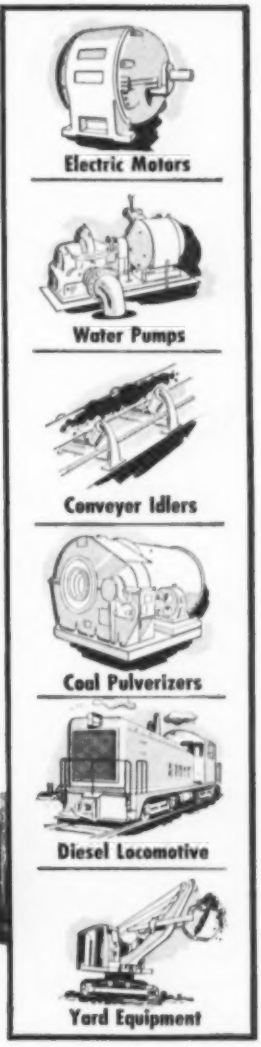
"Indianapolis Power & Light Company's large new White River plant uses Shell Alvania Grease on every one of these grease applications!"



Check the multiple qualities of this remarkable lubricant

Shell Alvania Grease is effecting important improvements in plant maintenance and purchasing practice. In plant after plant, this one grease is replacing the many special purpose greases formerly used . . . for *every grease application in the plant!*

Look at these advantages:

1. Shell Alvania Grease flows *freely* in cold temperatures, yet will not run out of bearings under excessive heat.

2. Ideal for wet, humid applications . . . it resists water emulsification.

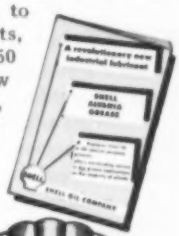
3. Shell Alvania Grease has extremely high oxidation stability.

4. You'll find that Shell Alvania Grease extends time between greasings . . . a substantial saving in labor and grease.

5. Simple inventory . . . just the one grease to stock and apply.

• • •

The economy of handling just one grease instead of *many* is an established fact. Write for the new booklet on Shell Alvania Grease . . . to Industrial Lubricants, Shell Oil Company, 50 West 50th Street, New York 20, N. Y.—or, 100 Bush Street, San Francisco 6, Calif.



SHELL ALVANIA GREASE

The True Multi-Purpose Industrial Grease

SHELL

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What it takes to make a 3000 Degree Refractory Concrete

Because of the widespread interest in the use of refractory castables, many furnace operators have asked us for the story behind the performance of B&W's unique refractory concrete, Kaocast.

Here are the answers to some of the most frequently asked questions:

Q. *When you refer to Kaocast as a 3000 degree refractory castable, do you mean that its melting point is 3000° F?*

A. No, this means that its service use limit is 3000° F; its melting point is 200 degrees higher.

Q. *Just what does it take to make a 3000 degree refractory castable like B&W Kaocast?*

A. Let's first define a few terms. Refractory castables are made with granular materials which are volume stable at high temperatures and which can undergo repeated heating and cooling cycles without disintegration. These materials, known as refractory calcines or grogs, are blended with suitable hydraulic binders. The initial strength of a refractory castable is thus developed in the same manner as that of ordinary concrete—that is, through the chemical action between water and the binder. A strong *ceramic bond* is formed when the refractory castable is subjected to temperatures above the vitrification point.

Q. *Then you have a grog, a binder and a method of putting them together. Which is most important?*

A. You can't say that any *one* is most important. It's a combination of all three. Let's take them one at a time. Our grog consists primarily of the proper blend of kaolin and other alumina-silica materials. This ratio enables us to achieve a grog with minimum expansion and shrinkage, a high fusion point, and greater stability under load, at varying temperatures.

Q. *And now, what about the binder?*

A. There are a number of factors responsible for the success of the Kaocast binder. One is the compound Tricalcium Penta-aluminate (3 lime to 5 alumina). This formula produces the most refractory compound (highest melting point) that can be made from lime and alumina. Another is that by using the purest commercially available lime and alumina, the Kaocast binder is substantially free of iron and silica. Such traces of these that are present combine during the prefiring of the binder to produce stable compounds.

Q. *Just how important is the manufacturing or "blending" of the grog and the binder?*

A. If one factor could be singled out as "most important" it would be quality control.

Direct control over the fineness of materials, prefiring temperatures, and other phases of manufacture is possible at B&W because both the grog and the binder are made and blended at B&W's Augusta Works—under B&W's direct control and supervision.

Q. *These factors you've discussed must add up to some specific advantages of Kaocast. What are they?*

A. B&W Kaocast has all the advantages of easy installation which are responsible for the widespread interest in refractory concretes, plus these exclusive features: It is the only 3000 degree refractory concrete with high resistance to spalling and low volume change throughout its operating range.

THE BABCOCK & WILCOX CO.
Refractories Division
General Offices:
161 East 42nd St., New York 17, N. Y.
Works: Augusta, Ga.

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STRIP HEATERS

In straight lengths, formed or "finned" for conduction or convection heating. Industry's rugged and versatile heat source for many uses.

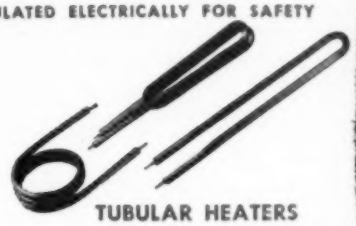
CARTRIDGE HEATERS

Installed in an instant in drilled holes for heating dies, platens, moving parts, rolls, molds, etc. Types available for immersion heating in liquids.

SHEATHED IN METAL FOR STRENGTH—INSULATED ELECTRICALLY FOR SAFETY

IMMERSION HEATERS

For heating water, oil and other liquids. Wide variety of types and sizes for portable or permanent installations, with or without built-in thermostats.



TUBULAR HEATERS

Straight lengths or tailored to any desired shape. For heating liquids, solids or gases by conduction, convection or radiation. Many sheath types.

Your LOW COST SOLUTION to processing heat problems!

Chromalox Electric Heaters give you quick, on-the-spot heat for a wide range of uses. They provide dependable, efficient, economical around-the-clock service in applications requiring continuous, accurately controlled temperatures. Thousands of plants in all industries have found Chromalox Heaters the low cost solution for heating liquids and gases; for heating dies, platens, moving parts; for superheating steam and pre-heating oil; in fact—for almost every industrial application using heat.

CHROMALOX

OFFERS YOU THE MOST IN ELECTRIC HEAT

Selection . . .

Over 15,000 types, sizes and ratings fill most applications needing heat up to 1100° F.

Engineering . . .

Research, development and technical personnel provide a vast reservoir of industrial heating know-how.

Experience . . .

World's largest manufacturer of electric heating units exclusively. 35 years of designing and manufacturing skills.

Service . . .

Over 130 field engineers in 36 key cities give on-the-job assistance and counsel.

10-78

CHROMALOX

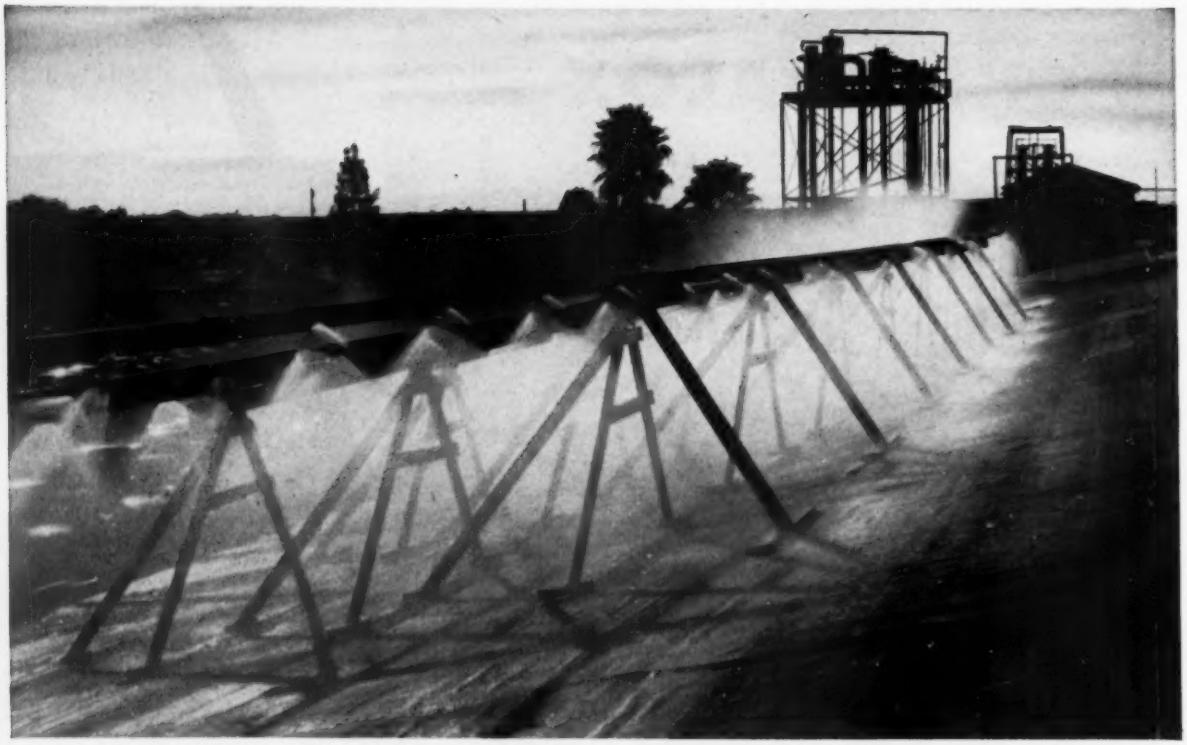
Electric Heat for Modern Industry

YOURS
without obligation

Catalog 50 is a storehouse of valuable information and data on many of the 15,000 Chromalox Electric Heating Units. Write today for your copy.

EDWIN L. WIEGAND COMPANY, 7520 THOMAS BOULEVARD, PITTSBURGH 8, PA.

Circle 542 on Reply Card for more data



PROCESS WATER IS AERATED AND COOLED on the roof of the Lakeland Highlands Canning Company plant in Highlands City, Fla. A Worthington vertical turbine pump, operating since 1940, supplies cooling water used in freezing orange juice concentrates, cooling canned products, and general washing.

"TROUBLE-FREE, DEPENDABLE SERVICE FOR 13 YEARS." That's what Leon Anderson, plant superintendent at Lakeland, says about this sturdy Worthington vertical turbine pump.

Not one cent's worth of maintenance needed in 13 years of pump operation

That's the record of the Worthington vertical turbine pump owned by the Lakeland Highlands Canning Company in Highlands City, Florida.

Since 1940 the pump has been working 24 hours a day, seven days a week during the citrus season, delivering over 800,000 gallons of water daily. And in all that time, not a single maintenance job has been necessary. This kind of reliable performance is particularly important at Lakeland, since all plant operations depend on the water supply and a failure would bring the plant's production to a halt.

Find out for yourself why the powerful Worthington vertical turbine pump is the choice of leading food, chemical and industrial firms. Get in touch with your nearest Worthington district office or write to Worthington Corporation, Vertical Turbine Pump Division, Section D.3.4, Succasunna, New Jersey, or Denver, Colorado. Ask for our new bulletin, W-450-B39. D.3.4

WORTHINGTON

THE WORLD'S BROADEST LINE ASSURES YOU THE RIGHT PUMP FOR EVERY JOB

CENTRIFUGAL • ROTARY • STEAM • POWER • VERTICAL TURBINE

CONSERVE GROUND WATER . . . IT IS A VALUABLE RESOURCE

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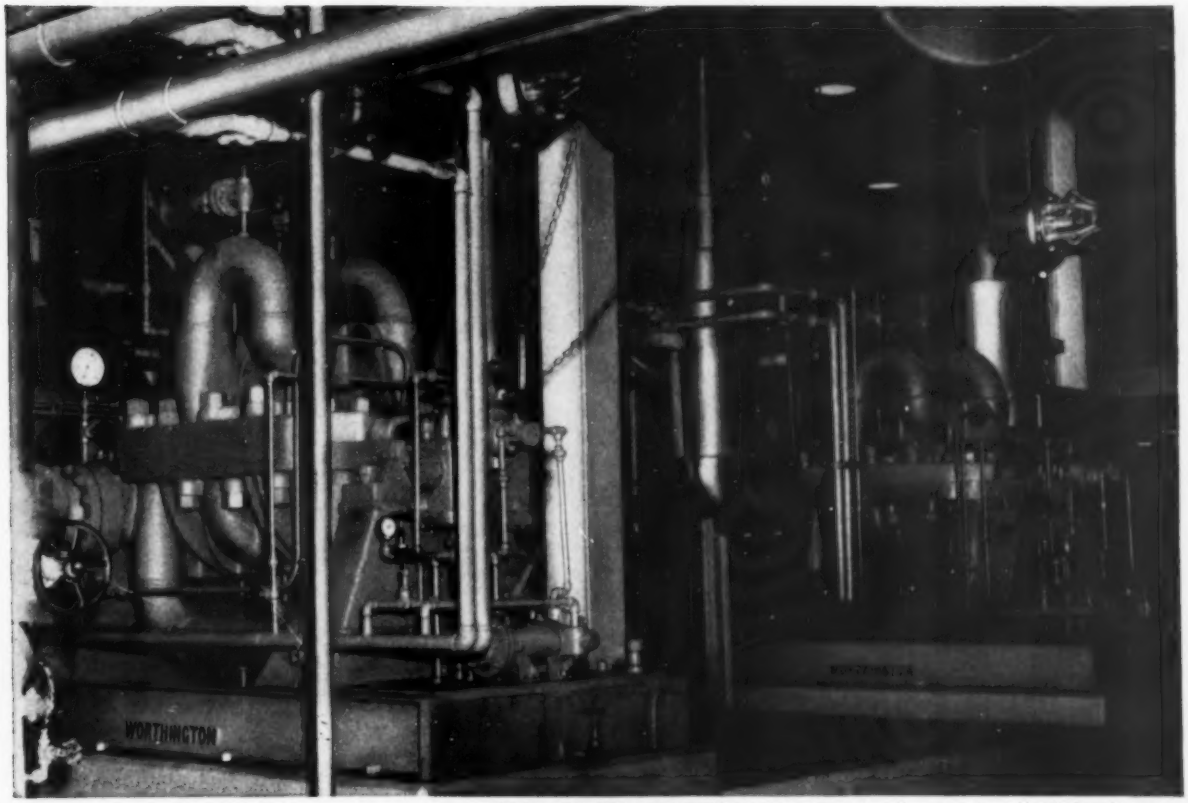


THIRTY WORTHINGTON BOILER FEED PUMPS have been purchased by the Southwestern Public Service Company of Amarillo, Texas. The two boiler feed pumps above, installed at Southwestern's new Plant X, deliver 1165 gpm, at 1125 psi total head.

Worthington helps bring more power to the Southwest

30 Worthington boiler feed pumps installed by Southwestern Public Service since 1945

Plant X, ten miles north of Amherst, Texas, is the newest and largest of the Southwestern Public Service Company's eleven generating stations. Since September, 1945, Southwestern Public Service has been expanding, building new stations to meet the Southwest's increasing power needs.

Worthington has played an important part in this expansion. During the past eight years, thirty Worthington boiler feed pumps have gone into Southwestern Public Service power plants. In Plant X alone, Worthington has supplied, in addition to the boiler feed pumps, heater drain pumps, water softeners, sump pumps, air compressors, and the open feed-water heater.

Power engineers everywhere have found that Worthington has kept pace with the increase in capacity and pressure of steam generating units and is prepared to furnish boiler feed pumps for any modern power plant requirements.

We'd like to hear about your own pumping problems. Get in touch with your nearest Worthington district office, or write directly to Worthington Corporation, Centrifugal Pump Division, Section C.3.5, Harrison, N. J.

C.3.5

For Boiler Feed Service. Capacities to 1,500 GPM; Heads to 1,000 feet.

For Hotwell, Condensate, Chilled Water Service. Capacities to 1,400 GPM; Heads to 650 feet.

For Water Works, Circulation, Drainage, General Service. Capacities to 135,000 GPM; Heads to 400 feet.

For Boiler Feed Service. Capacities to 3,000 GPM; Heads to 7,000 feet.

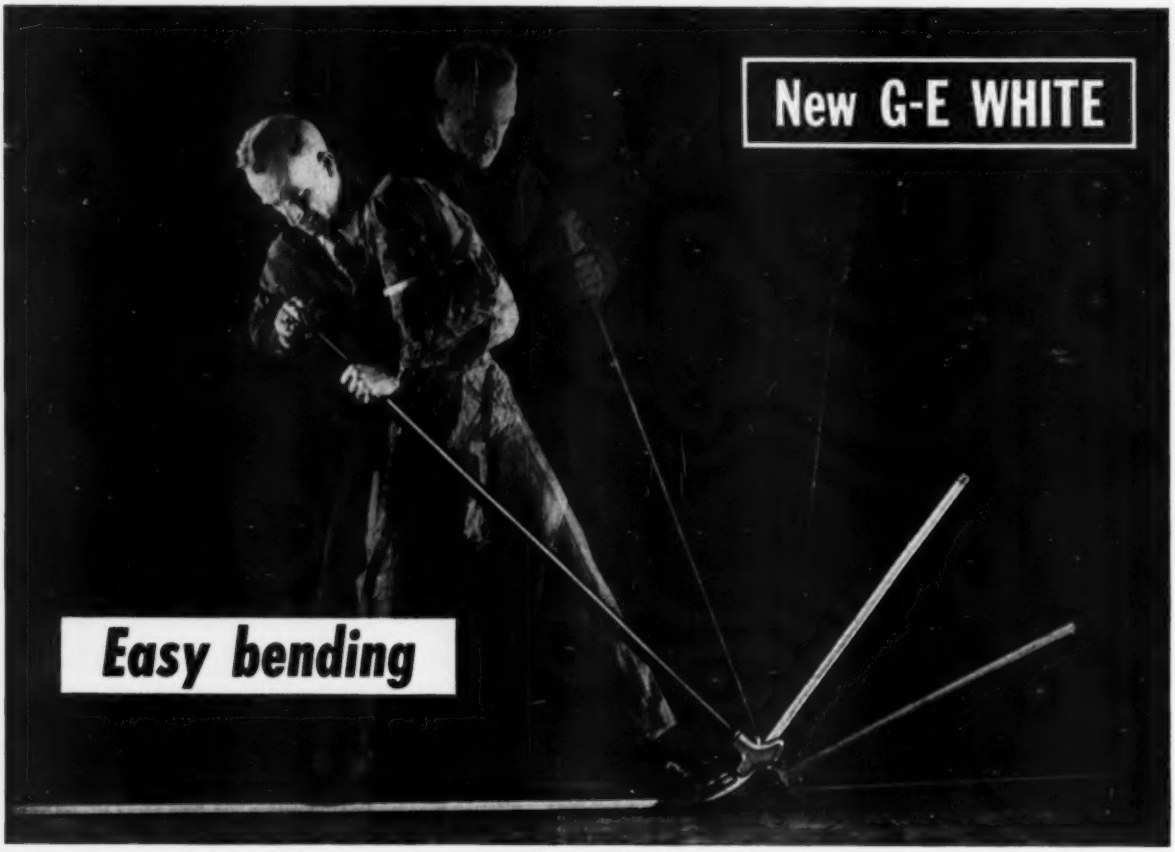
WORTHINGTON

Centrifugal Pumps

The World's Broadest Line Assures You the Right Pump for Every Job

Circle 544 on Reply Card for fare data.

G.E. Announces New Rigid Conduit

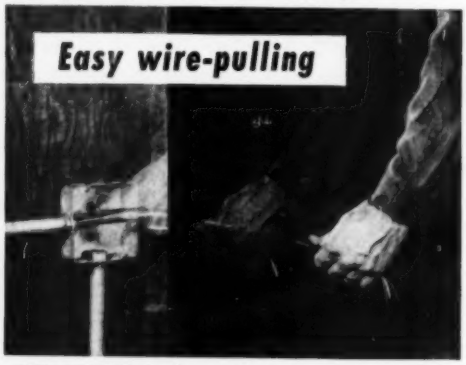


A new G-E WHITE rigid steel conduit that has easy bending, easy wire-pulling, and improved corrosion-resistance characteristics has been introduced by General Electric's Construction Materials Division.

These improvements have been made possible by a zinc-coating process called "metallizing", which has been proved by more than 30 years of service in other applications. Metallizing bonds a controlled, uniform coating of pure zinc to the conduit, threads and all, to provide lasting protection against corrosion. The conduit is then given the added protection of a coating of C-553 lacquer over the metallized zinc.

New G-E WHITE rigid conduit conforms with the American Standards Association specifications, is listed by Underwriters' Laboratories, Inc., and meets all U. S. Government specifications. Ask your distributor about it. Section C25-1044 Construction Materials Division, General Electric Company, Bridgeport 2, Conn.

New G-E WHITE is easier to bend because the "metallizing" process flame-coats the zinc to the conduit—eliminating the quenching and straightening that cause hardening.



Wire-pulling is easier because new G-E WHITE is lined with a new corrosion-resistant coating, containing an anti-friction agent.

You can put your confidence in—

GENERAL ELECTRIC

Circle 545 on Reply Card for more data

JOHN ZINK JZ SERIES YC

COMBINATION GAS & OIL BURNER

The John Zink Series YC Combination Gas and Oil Burner is particularly designed for boilers and process furnaces where maximum heat release at low excess air and high heat density place a premium on reliable burner performance at low first cost.

MAXIMUM DUTY — MINIMUM DRAFT.
RUGGED WEATHERPROOF CONSTRUCTION.
SIMPLE IN DESIGN.
LIGHT-WEIGHT FUEL GUNS ARE EASY TO REMOVE.
BURN ANY COMMERCIAL FUEL OIL.
BURN ANY GAS AT REASONABLE PRESSURE.
DRAFT MAY BE NATURAL, INDUCED OR FORCED.
CHROMIUM ALLOY STEELS FOR HEAT AND CORROSION RESISTANCE.
CENTER FIRING WITH BOTH FJELS ASSURES EQUALLY SATISFACTORY OPERATION WITH EITHER FUEL.
ANY AIR TEMPERATURE MAY BE USED.

JOHN ZINK AIR HEATER

John Zink Air Heaters are already being reordered—they must be good. Air Heaters, individually fabricated to meet specifications, are available as Horizontal or Vertical Units. Equipped with a special JZ Air Heater Burner, electric ignition gas pilot and complete safety control equipment as specified. John Zink will furnish the burner for your fabricated heater.

JOHN ZINK FIELD FLARE BURNERS For . . .

- OIL REFINERIES
- CHEMICAL PLANTS
- STEEL MILLS
- GASOLINE PLANTS
- SEWAGE DISPOSAL PLANTS

or any industrial facility where substantial volumes of combustible gases must be dissipated.

JOHN ZINK COMPANY

4401 So. Peoria **Tulsa, Oklahoma**

Circle 546 on Reply Card for more data

Condor V-Belts—More use per dollar

Condor V-Belts—More use per dollar

Condor V-Belts—More use per dollar

Condor V-Belts—More use per dollar

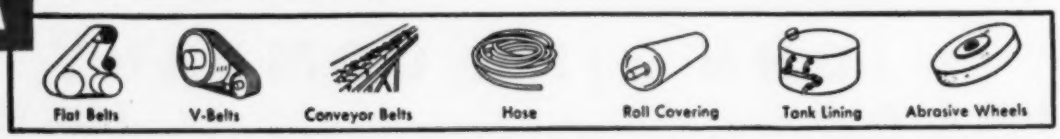
Condor V-Belts—More use per dollar

Condor V-Belts—More use per dollar

LOWER V-BELT DRIVE COSTS . . . for several reasons . . . Straight sidewalls provide more grip, less slip, longer life. Every Condor V-Belt is destretched during manufacture, and the pulling section is micro-positioned where good engineering says it should be. This gives you a smooth running drive, saves downtime for belt take-ups. You get longer V-belt life . . . MORE USE PER DOLLAR. Also in special oil-, heat-, and static-resisting types . . . Get the engineering facts. Ask the R/M distributor for Bulletin 6868 . . . He'll tell you, too, how you get MORE USE PER DOLLAR with R/M hose, transmission and conveyor belts.

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.



Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings Asbestos Textiles • Teflon Products • Packings • Sintered Metal Parts • Bowling Balls

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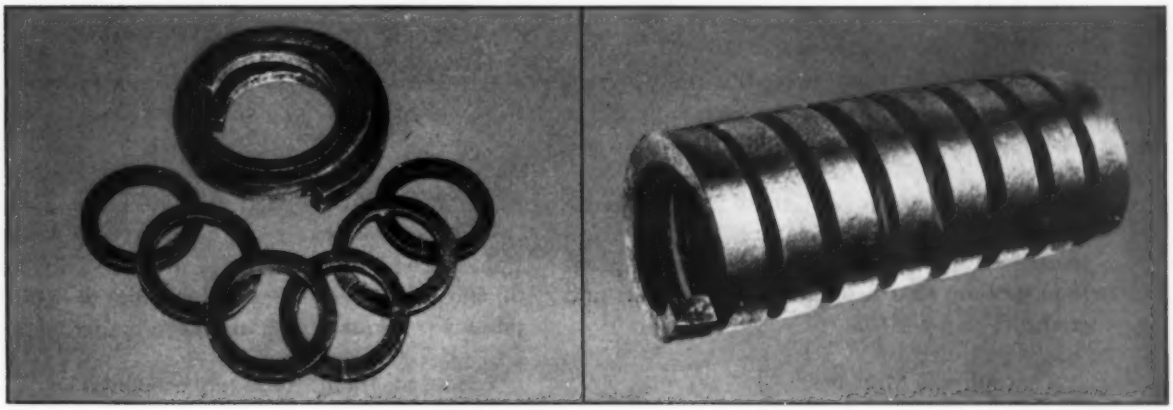
Standardize...and save!...on R/M's BIG 7 packing types

When you standardize on R/M's new basic line of just seven field-tested packing types, you *save* by lowering your inventories, *save* by simplifying your ordering, *save* by reducing your downtime. R/M's "Big 7" Packing Types cover 95 percent of all packing needs — all but the very rarest packing applications. Your plant's needs can probably be met with just three or four. Take advantage of this really revolutionary packing development. Your distributor has the full story.



Here's the story on TYPE 1

Type 1: R/M Universal Plastic Packing and "versi-pak."® In Universal Plastic Packing, R/M has combined asbestos fiber and graphite with lubricant and binder. 1840-A is a basic universal packing. In 1840-C the binder has been varied so that the material is highly oil resistant. In 1840-D mica is used instead of graphite so that the packing will be sanitary for food processing equipment. These packings are recommended for circulating, reciprocating and centrifugal pumps, including boiler feed pumps.

In "versi-pak" (No. 1845) the combination of ingredients has been slightly changed and a special solvent proof binder is used. This packing is recommended for rotary solvent installations and reciprocating solvent pumps up to 350° F. and/or 600 psi pressure.

R/M PACKINGS
RAYBESTOS-MANHATTAN, INC.
PACKING DIVISION, MANHEIM, PA.

FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Passaic, N.J.; Neenah, Wis.; Crawfordsville, Ind.; Peterborough, Ontario, Canada

RAYBESTOS-MANHATTAN, INC., Manufacturers of Packings • Teflon Products Asbestos Textiles • Industrial Rubber Products • Abrasive and Diamond Wheels Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Fan Belts • Radiator Hose • Sintered Metal Products • Bowling Balls

Circle 548 on Reply Card for more data

When you need a good general-purpose alloy —try Monel!

Expanding Monel tube into the head of a high-pressure feed-water heater. Here's an example of where Monel's high ductility combines with its other characteristics to make it the perfect metal for the application.

Today, even the most "up-to-the-minute" metallurgist finds it hard to keep pace with all the alloys and their many applications.

But, in the power field, there is one general-purpose alloy with sufficient all-round usefulness to solve a number of metal selection problems – pump shafts, impellers, valve seats and stems, to name a few.

That alloy is Monel®!

Monel is a solid solution alloy with good strength (twice that of brass and equal to structural steel). And it retains its strength at operating temperatures of 700-800° F.

It has good resistance to corrosion, cavitation and erosion. And its high ductility provides good workability. It is supplied in all general mill forms as well as in castings.

You can get some idea of how useful Monel can be when you consider just one application —high-pressure feed-water heater tubes—where it proves to be the *only* answer.

Here's a job that calls for a strong, corrosion-resisting metal with good heat transfer properties and high resistance to erosion and cavitation. In addition, the metal must be capable of standing operating pressures up to 3,000 pounds per square inch and even higher.

Monel meets *all* these requirements!

There are all kinds of applications in which this versatile alloy can be helpful. For more information on its characteristics and uses, write for Technical Bulletin T-5, "Engineering Properties of Monel and 'R' Monel."

It is advisable to place equipment orders with your suppliers well in advance of scheduled use. Distributors of Inco Nickel Alloys can supply the latest information on availability from warehouse and mill.

The International Nickel Company, Inc.

67 Wall Street, New York 5, N. Y.

Inco Nickel Alloys INCO TRADE MARK

MONEL® • "R"® MONEL • "K"® MONEL
"KR"® MONEL • "S"® MONEL • NICKEL • LOW CARBON NICKEL • DURANICKEL® • INCONEL® INCONEL "X"® • INCONEL "W"® • INCOLOY® • NIMONIC® ALLOYS

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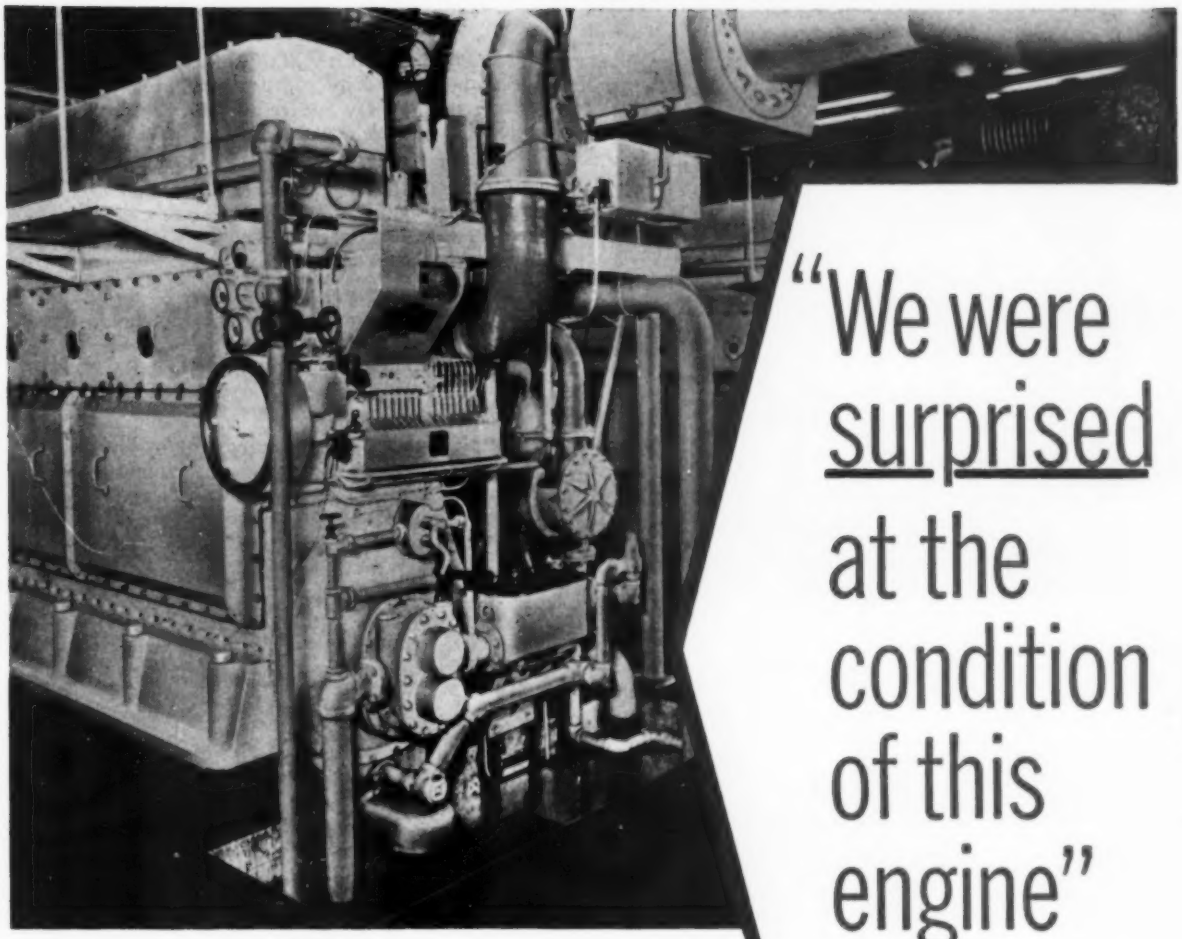


"We were surprised at the condition of this engine"

... says G. V. Yarger,
Supt. Municipal Utilities
Waverly, Iowa

"When we finally opened up our Worthington, it was in the *best* condition I've ever seen a diesel engine that had operated such long hours and under such heavy loads as this unit. It had a total of 48,926 hours on it – 8,987 hours of tough operation since the last overhaul.

Mr. Yarger continues, "We've been using Sinclair RUBILENE® Heavy in the crankcase and RUBILENE H.D. 30 in the cylinder lubricator. These RUBILENES have kept the crankcase and upper portions of the cylinders exceptionally clean and bright, with no sign of carbon or deposits."

That's a typical report on the exceptional qualities of the Sinclair RUBILENES ... evidence that they could improve the efficiency of *your* diesels, too. Why not switch now? Contact your nearest Sinclair Representative or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR DIESEL OILS

save wear and replacements

Circle 550 on Reply Card for more data

Guaranteed TO SHUT TIGHT*

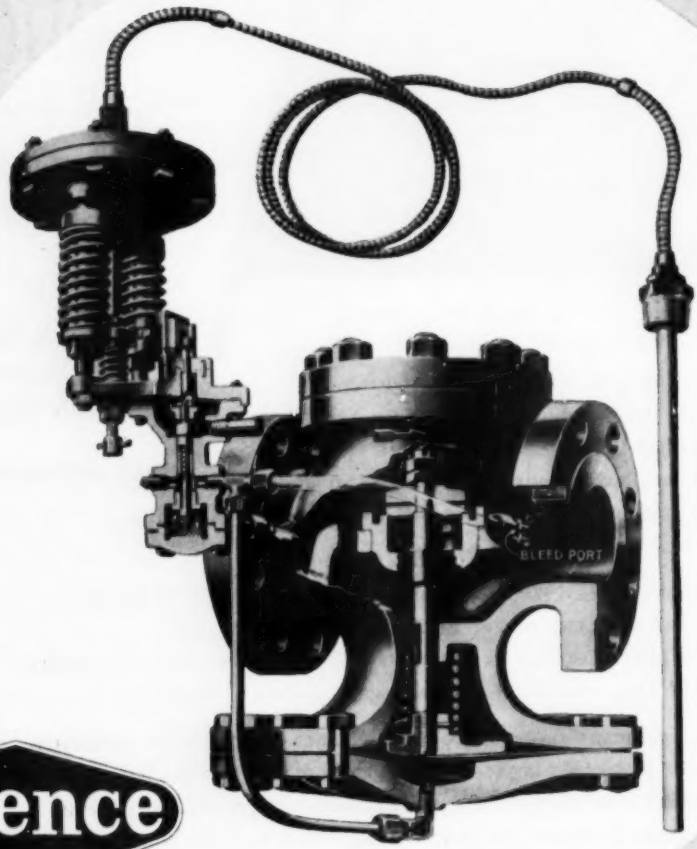
*When equipped with a SECO Metal Seat and Disc on steam service and protected by an approved Strainer, a Spence Regulator is guaranteed to shut tight when the demand for steam ceases.

Expensive steam leaks due to a lack of absolutely tight shutoff are eliminated in Spence Temperature Regulators. Here is why we can make such a guarantee:

First, our temperature regulators are of the single seat design. Seats and discs are made of durable SECO Metal. More than 20 years experience in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

These plus other design features explain why Spence Temperature Regulators function dependably and accurately year after year without requiring expensive repairs or special attention.

Want more facts? Write for Bulletin T50 giving full details.



SPENCE
TYPE ET150
Temperature
Regulator

Spence

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

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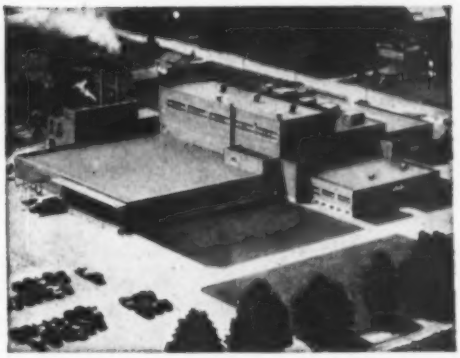
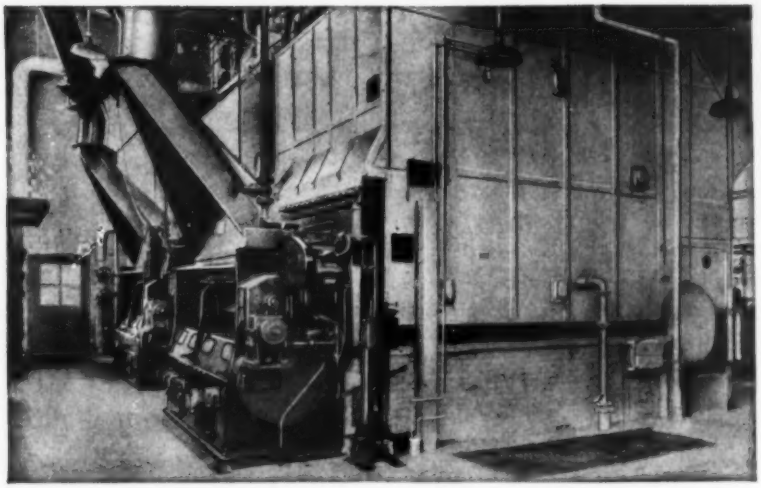
"COAL'S BEST FOR OUR MODERN PLANT!

It's low in cost . . . It's clean and convenient!"

says G. W. Peters, Engineering Manager
M&R DIETETIC LABORATORIES, INC.
makers of PREAM & SIMILAC





"We made a careful study of fuels and burning equipment before building our modern new plant in Sturgis, Michigan. This plant was designed to produce baby food. So the steam plant has to be clean and dust-free as well as economical to operate. Also, we wanted a fuel we could store safely and easily in order to insure ourselves against any shortages.

"We decided on bituminous coal—and the up-to-date installation shown here. It certainly fills the bill on every count. Our modern combustion equipment makes coal far more economical than any other fuel. Up-to-date coal and ash handling give us convenient operation completely free of dust nuisance."

Additional case histories, showing how other types of plants have saved money by burning coal the modern way, are available upon request.

Discover for yourself the great advantages of coal burned the modern way. Call in a consulting engineer. He'll show you how today's combustion equipment can give you 10% to 40% more power from a ton of bituminous coal than from equipment used only a few years ago. He'll show you how modern labor-saving coal and ash-handling equipment make a coal-fired installation clean, convenient, and dust-free.

If you plan to remodel or build a new plant, be sure to look into the low cost and convenience of bituminous coal. Consider coal's other advantages, too. It has reserves that are virtually inexhaustible. America's bituminous coal mining industry is the most efficient and productive in the world. With bituminous coal, you can be sure of plenty of fuel at relatively stable prices now and for years to come.

If you operate a steam plant, you can't afford to ignore these facts!

BITUMINOUS COAL in most places is today's lowest-cost fuel, and coal reserves in America are adequate for *hundreds of years to come.*

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

BITUMINOUS COAL INSTITUTE
A Department of National Coal Association, Southern Building, Washington 5, D. C.

FOR HIGH EFFICIENCY FOR LOW COST

YOU CAN COUNT ON COAL!

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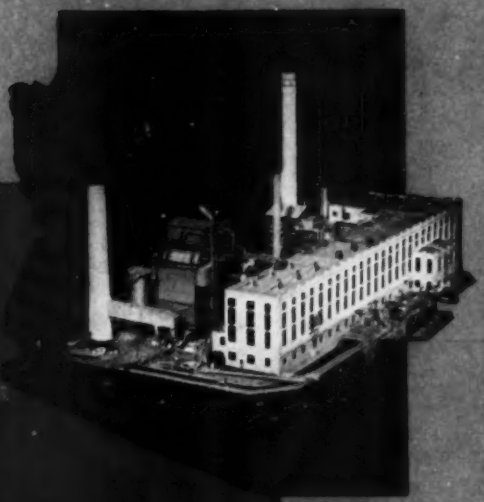
ALSO IN ARIZONA, IT'S YARWAY



PUBLIC SERVICE

PICKS

YARWAY UNIT TANDEMS

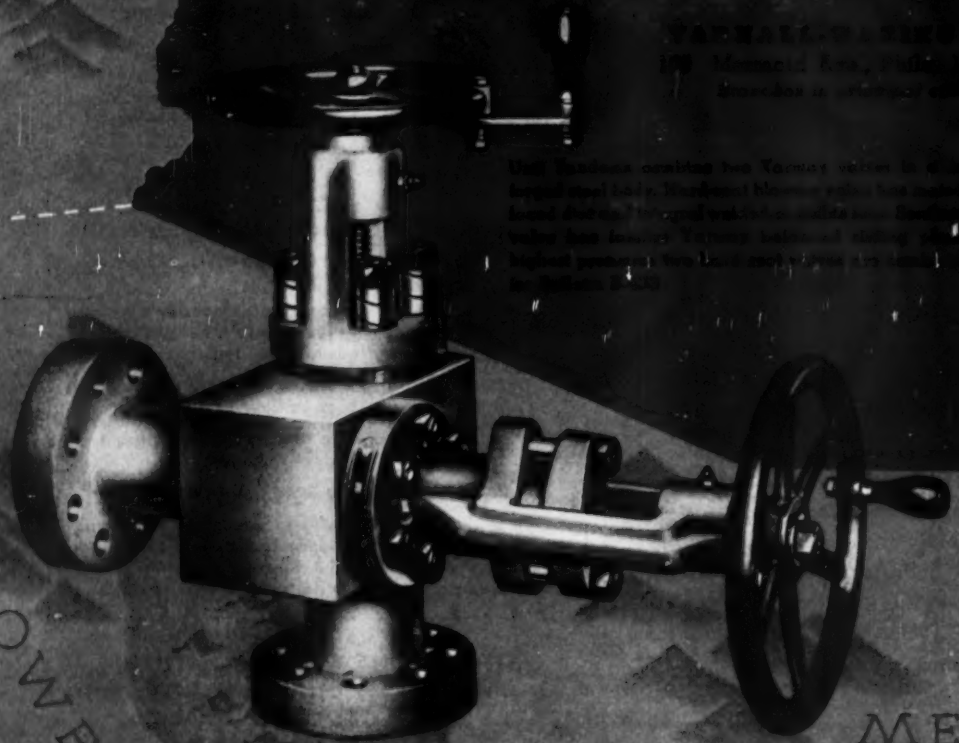
FOR V2G PRE-BLOW-DOWN SERVICE

Arizona Public Service Company—operating in the prosperous but fast of our fastest-growing states—is another prominent utility that relies on Yarway Unit Tandem Blow-Off Valves to guard its investment. In fact, 4 out of every 5 high pressure boiler plants are Yarway equipped.

Such popularity had to be won. It was—by offering good design, careful engineering and manufacturing, accurate metallurgy and dependable service.

Yarway engineers are strategically located near you and are equipped and trained for giving more profitable steam plant performance. Need help? Call a Yarway man.

YARWAY-CRANE CO.
[illegible] Penna.



Unit Tandems combine two Yarway valves in a one-piece, forged steel body. Readout blowoff valve has seated stellite-faced discs. Supply valve has a stellite-faced disc and stellite-faced seat. Yarway balanced stuffing gland. For highest pressures, two Unit Tandems are used in the Weldo Pre-Blowoff [illegible]

MEXICO

YARWAY SERVICE GOES ALL THE WAY....

Circle 353 on Reply Card for more data

Versatile automatic plating conveyor is the focal point for other equipment installed in coordinated plant layout.

Smart Planning and Good Layout

Turn Job Lot to Mass Production

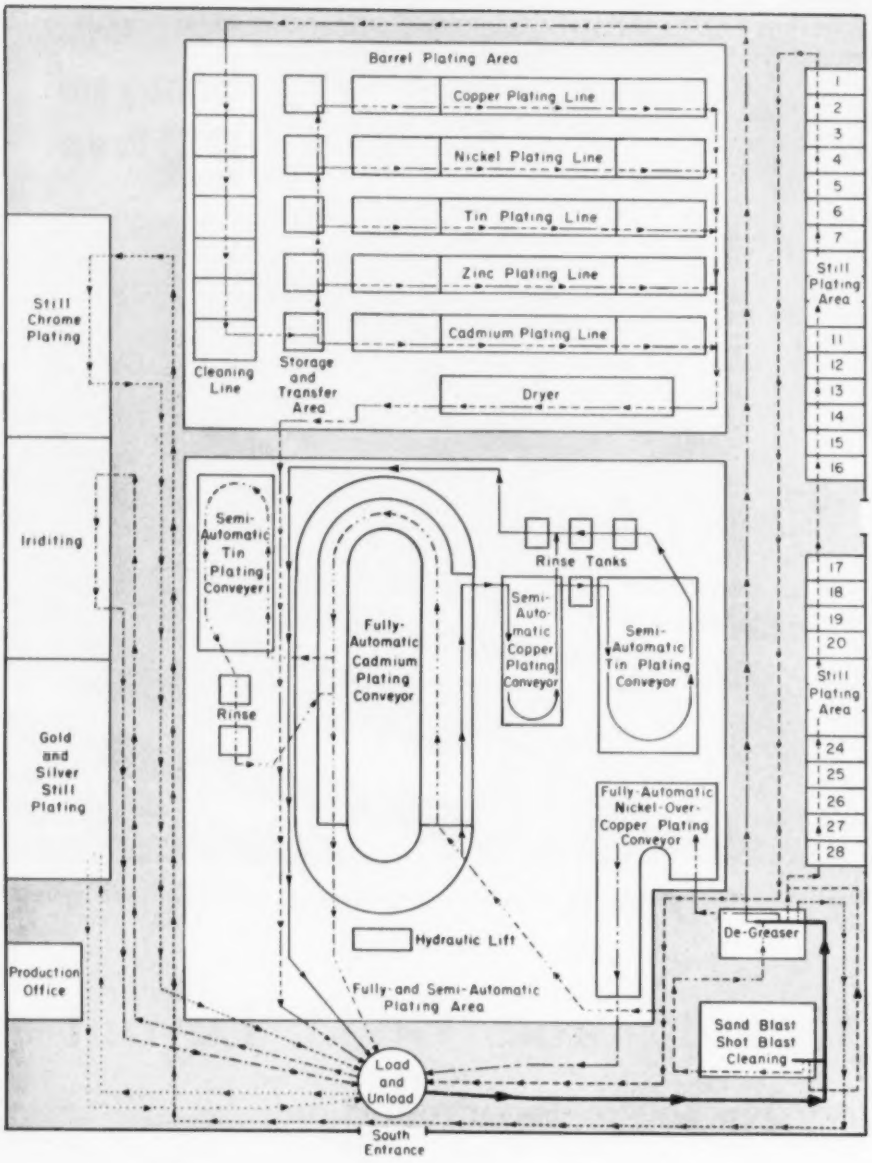
Union Switch and Signal has built a new plant which is a model of coordinated planning. Here, job lot plating enjoys the benefits of mass production.

THIRTY YEARS AGO, Union Switch and Signal, the nation's primary supplier of railway traffic and safety equipment, installed the first of its plating facilities on the fifth floor of one of its main manufacturing buildings. Additional equipment was added piecemeal from time to time; the plating department literally grew without overall plan.

As years went by, U. S. and S. found that its plating department was imposing building maintenance costs of some $7000 per month. Their experience, paralleled by many manufacturers whose plating facilities had also expanded by small increments, indicated that operating costs and plating quality could be vastly improved by an integrated plating plant which would tie all processing together in more logical physical order and operational relationship.

The next move was a determined design program for the creation of a plant which would produce uniformly high quality plating, would allow flexibility in choice of plate, afford maximum protection against corrosive fumes and liquids, provide maximum worker comfort, and have lower operating costs.

All these aims have been achieved in U. S. and S.'s new plant. Maintenance costs have been reduced from the $7000 per month figure to $1000 per month. Even before completing a full year of shakedown operation, manpower levels have been



Arrangement of equipment in new U. S. and S. plant and well-planned materials traffic afford versatility.

reduced 40 percent. Long range planning with union representatives resulted in an equitable reassignment of personnel around U. S. and S. so that no inequities resulted. Because of this planning, no labor troubles of any kind arose.

Plating quality is so improved that substantial reductions have resulted in machining time and there is less waste of metals in many applications. Such cost reductions are suggesting that these cost savings may well outweigh shipping costs if plating for other Westinghouse Air Brake Company units was done by U. S. and S. in Swissvale, Pa. Control over quality and delivery schedules becomes absolute, too.

Versatility characterizes the new U. S. and S. plating plant. In a building 90 x 200 feet, anything from countless small screw machine parts to large equipment cabinets can be completely made ready for plating. Depending upon specifications, plate is available in copper, nickel, zinc, cadmium, chrome, gold, silver, or tin. Facilities for iriditing, aluminum anodizing, bonderizing, enthonizing, and parkerizing are also installed. Plating methods consist of full-automatic, semi-automatic, barrel, and still processes.

All work enters and leaves the plant through the south entrance. From here, production control procedures insure that each batch is directed over the plant's integrated materials handling system to preparation stations and then onto the plating processing stations. All batches follow predetermined routes over conveyances especially suited to the parts and to the route. Where different parts undergo similar treatments, handling equipment was selected to accommodate all anticipated loads.

In the layout of plant facilities, and in the handling equipment for carrying parts between work stations lies the flexibility which permits job lot plating on a production line basis.

Flexibility in plating operations themselves is insured by in-line layout of successive cleaning, pickling, rinsing, plating, and drying stations. Largest single machine is a fully-automatic, elevator-type, heavy-duty processing and cadmium-plating conveyor. This machine was developed, built, and assembled especially for U. S. and S.

Several semi-automatic machines are installed to work in conjunction with the big automatic. It was planned that this machine could be efficiently designed to do all pickling, cleaning, and rinsing for the semi-automatics. The plant layout and handling equipment were both slected with this kind of arrangement in mind.

Typical Cycle

In a typical cycle, cadmium is plated on parts sent through 17 successive treatments requiring 39 minutes from start to finish. Variations in all process steps are possible to accommodate different plating specifications. As long as the total surface areas to be plated on successive batches are within limits, countless varieties of parts can im-

mediately follow each other in the successive stations through the automatic and semi-automatics, each batch being routed through its designated plating bath.

Still plating equipment complements the automatic, semi-automatic, and barrel plating facilities by permitting individual attention where special parts might need abbreviated or extended treatments at various stages of the plating cycle. Such variations may be outside the practical operating limits of other equipment, especially if only a few parts are involved and resetting automatic cycles is not really warranted.

Corrosion Protection

Corrosion is a universal problem in industry and can be particularly vexing in a plating plant. Spilled liquids and corrosive fumes are sure to be present. Waste and overflow liquids in the plant are carried away by troughs built into the floors and covered with cast iron gratings.

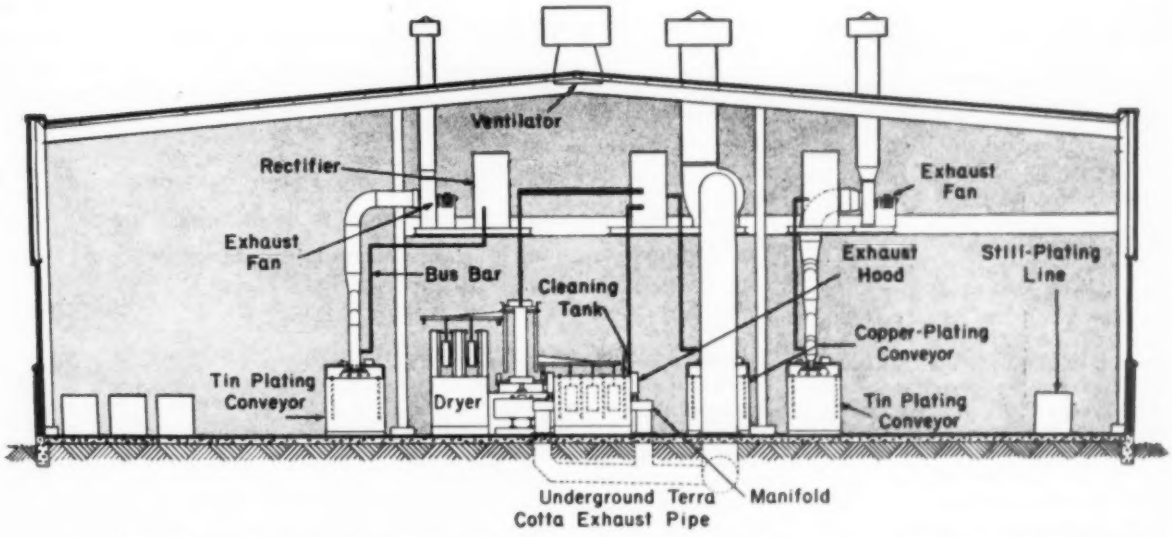
Fumes are drawn off the liquid surfaces from all tanks containing corrosive fluids and are pulled by a downdraft system into underground terra-cotta ducts. The cool underground ducts condense the fumes and send the condensate into the plant's waste disposal system. The downdraft ventilation eliminates extensive piping in working areas, assures minimum exposure of personnel to fumes, and does away with any necessity for expelling noxious fumes to the outside air. The entire plant is ventilated by an extensive up-draft down-draft system; there are no building openings to the outside except through two doors, exhaust fans, and space heating coils built into the north wall.

Typical of the techniques employed to maximize flexibility is this barrel plating area served by an integrated network of motor-driven hoists.

Electrical Distribution

Electrical power is distributed in the plant at 440 volts, 60 cps, 3-phase. The power is brought to the plating tanks through some 14 rectifiers, each located overhead above its load. Direct current is supplied to the plating tanks at 6 and 12 volts and in ratings as high as 36 kw to a single tank. The total d-c capacity for plating is 20,900 amperes at 6 volts plus 9000 amperes at 12 volts.

It is fully expected that cost savings will permit complete write-off of the new plant within five years' operation on single shift. This estimate is further based on operating the plant for the company's own requirements, furthermore, after serious consideration, U. S. and S. has made the plant facilities available to other manufacturers who might also like to place their job lot plating on a production line basis.



This cross section shows the down-draft, up-draft ventilation system for controlling fumes. Also shown are the overhead rectifiers installed above the plating tanks they serve; bus work carries direct current short distance down to electrodes.

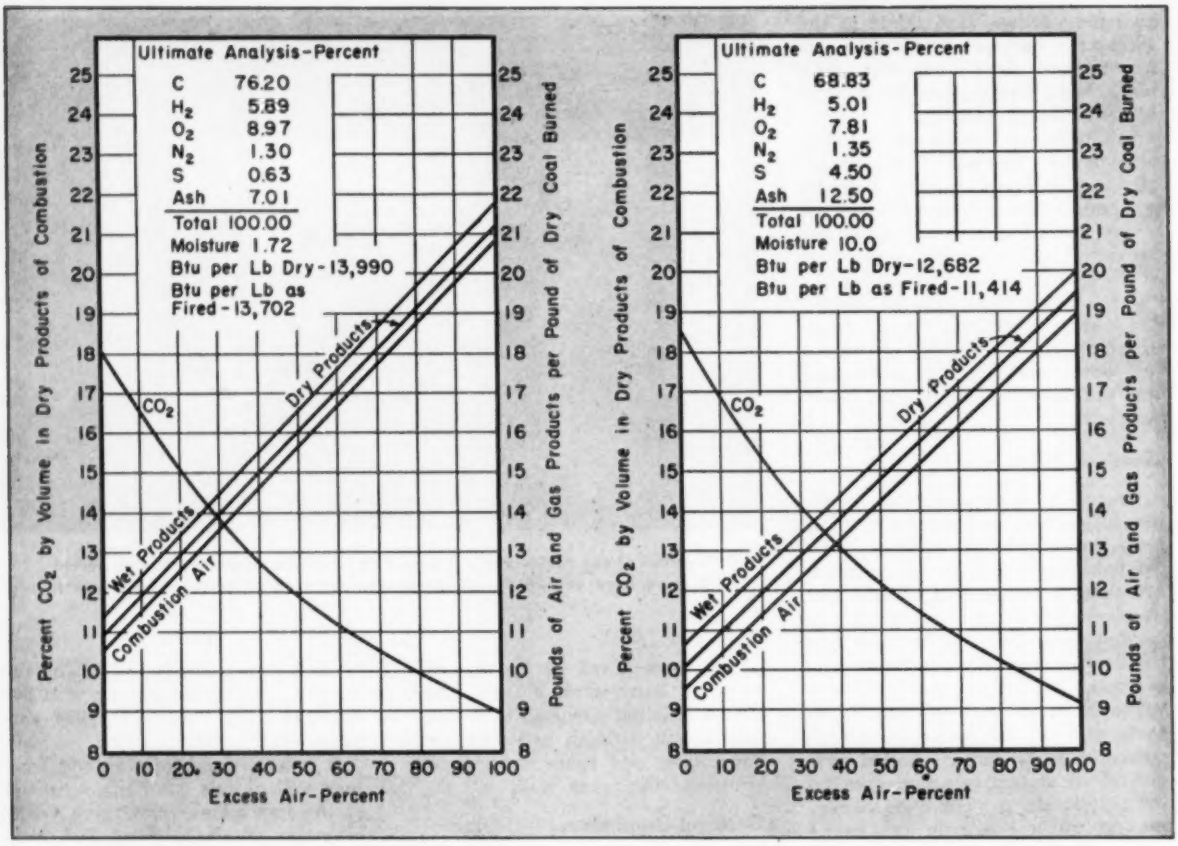


Fig. 1—Combustion data for the specified Eastern coal.

Fig. 2—Combustion data for the specified Midwest coal.

Can Your Boiler Burn Another Fuel

WILLIAM S. MAJOR, Project Engineer
Machinery Division, Dravo Corp.

To realize fuel flexibility, the steam generator and auxiliaries must have design features which satisfy wide variations in excess air and combustion products.

MAXIMUM AIR requirements and resultant combustion product volumes are important factors in the design of steam generating units and their auxiliaries. Basically, all fuels require practically the same theoretical weight of air per 10,000 Btu. This is demonstrated by Table 1 which shows theoretical air weights for the complete combustion of typical fuels, expressed on a basis of both one pound of fuel as fired and also per 10,000 Btu in the respective fuels. However, there is a very wide spread in the actual air quantities required for the practical burning of different fuels, because varying amounts of excess air are required.

Excess Air

Proper determination of excess air percentage for a specific condition necessitates the evaluation of many factors. It is influenced by the physical state of the fuel in the combustion chamber, the size of the particles when burning solid fuels or the viscosity when firing oil, and the proportion of inert matter in the fuel. Design of the furnace and fuel burning equipment also must be considered.

In general, solid fuels require the greatest amount of excess air and gaseous fuels require the least. If the solid fuel is introduced into the furnace in a finely divided state (pulverized coal), it will require less excess air than when fed to the furnace in lumps. When the stoker, burner, or furnace design imparts a high degree of turbulence to the fuel and combustion air, the percentage of excess air may be re-

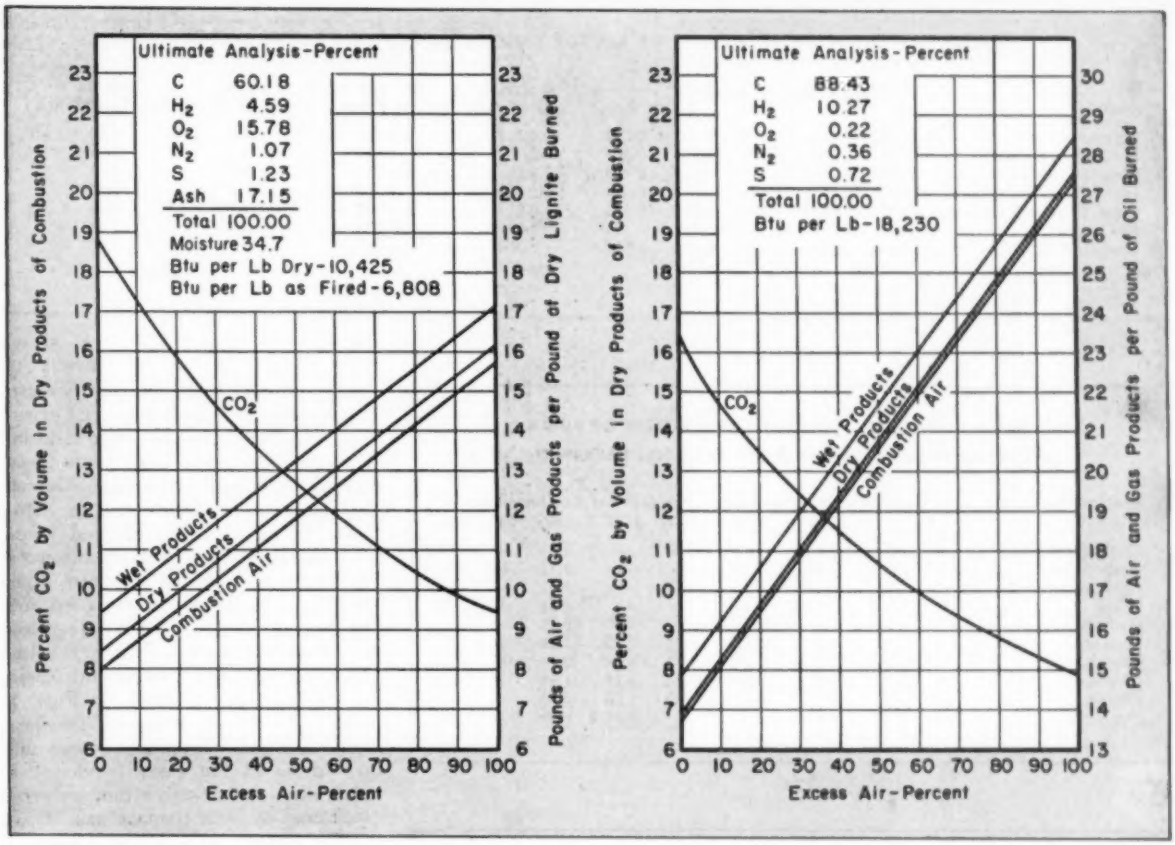


Fig. 3—Combustion data for the specified lignite fuel.

Fig. 4—Combustion data for the specified residual oil.

duced. For typical applications, percentages of excess air at the furnace outlet[1] commonly used for design purposes with different fuels are:

Type of fuel	Excess air, percent
Solid	
Coal	10-40
Coke	20-40
Wood	25-50
Bagasse	25-45
Liquid	
Oil	8-15
Gaseous	
Natural gas	5-10
Blast furnace gas	15-25
Coke oven gas	5-10

Since excess air is determined indirectly by measuring CO_2 in the products of combustion, performance generally is expressed as CO_2 by volume rather than in terms of excess air. For a given fuel analysis, there is a definite relationship between CO_2 and the excess air in the dry products of combustion. Thus, Figs. 1 to 6 have been developed to show the relationship of CO_2 to excess air and the corresponding air requirements and combustion products for six typical fuels with analyses as indicated. In addition, the steps in the development of Fig. 1 are summarized in Tables 2 to 5.

Method for Preparing Graphs

When preparing the graphs, the theoretical air requirements and gaseous product weights resulting from the perfect burning of the various combustible elements and compounds in typical fuels were obtained from Table 2[2]. Using this information and the coal analysis from Fig. 1, Table 3 was prepared to show the theoretical air and combustion product weights of 10.452 and 11.383 lb respectively. Then Table 4 was developed to show the influence of excess air.

Each 20 percent increase in excess air weight increases the combustion product weight by 10.452 x 0.20 = 2.09 lb. Since air is 23.15 percent oxygen and 76.85 percent nitrogen by weight, 2.09 lb of air consists of 0.484 lb of oxygen and 1.606 lb of nitrogen. These values are the basis of the incremental gaseous product weights shown in Table 4 for various excess air percentages. Table 5 was prepared by converting the weights in Table 4 to a volumetric basis[3], using a value of 358 for the pound molecular volume.

For the three grades of solid fuels (Figs. 1, 2, and 3), the same percentage of CO_2 corresponds very nearly to identical amounts of excess air. In the case of the other fuels shown on Figs. 4, 5, and 6, however, the same percentage of CO_2 is equivalent to widely different excess air. For example, 10.0 percent CO_2 with oil is equivalent to 60 percent excess air while the same percentage CO_2 with natural gas is produced by about 15 percent excess air. With blast furnace gas, because of its high inherent CO_2, a 23 percent CO_2 in the combustion products indicates only 20 percent excess air.

Multiple Fuel Firing

During recent years an increasing number of steam generators have been installed for burning two or more fuels. In the design of such units, combustion data on all of the fuels to be used must be considered. It is essential for determining proper boiler and furnace configuration,

TABLE 1 — THEORETICAL WEIGHT OF AIR FOR COMBUSTION OF ONE POUND OF FUEL

Fuel	Ultimate Analysis* C	H_2	O_2	S	Ash	Moisture per lb fuel	Btu per lb as fired	Air, lb per lb fuel	Air, lb per 10,000 Btu
Lignite	0.394	0.068	0.438	0.007	0.093	0.362	6,700	5.0	7.54
Illinois Bituminous	0.609	0.058	0.192	0.037	0.104	0.127	10,989	8.4	7.66
Ohio Bituminous	0.705	0.054	0.112	0.029	0.100	0.052	12,733	9.7	7.63
Pennsylvania Bituminous	0.757	0.054	0.103	0.012	0.074	0.035	13,700	10.3	7.50
West Virginia Bituminous	0.843	0.047	0.052	0.007	0.051	0.031	14,688	11.2	7.65
Anthracite	0.752	0.028	0.041	0.008	0.171	0.021	12,472	9.6	7.66
Crude oil	0.866	0.116	0.000	0.008	0.010	0.000	18,565	14.1	7.59
								Average	7.62

*Moisture included.

TABLE 2 — DATA ON PERFECT COMBUSTION OF FUELS

All values are expressed in lb per lb of fuel component.

Fuel component	Symbol	Air required O_2	Air required Air	Products of combustion CO_2	H_2O	N_2	CO	SO_2
Carbon (to CO_2)	C	2.667	11.52	3.667	—	8.85	—	—
Carbon (to CO)	C	1.333	5.76	—	—	4.43	2.333	—
Carbon monoxide	CO	0.572	2.46	1.57	—	1.89	—	—
Sulfur	S	1.000	4.32	—	—	3.32	—	2.00
Hydrogen	H_2	8.000	34.56	—	9.00	26.56	—	—
Methane	CH_4	4.000	17.28	2.75	2.25	13.28	—	—
Acetylene	C_2H_2	3.077	13.29	3.39	0.69	10.21	—	—
Ethylene	C_2H_4	3.429	14.81	3.14	1.29	11.38	—	—
Ethane	C_2H_6	3.733	16.13	2.93	1.80	12.40	—	—
Hydrogen sulfide	H_2S	1.412	6.10	—	0.53	4.69	—	1.88

TABLE 3 — THEORETICAL AIR AND COMBUSTION PRODUCT WEIGHTS

For perfect combustion of one lb of coal as specified on Fig. 1.

Fuel analysis lb per lb coal		Air required, lb O_2	Air required, lb Air	Products of combustion, lb CO_2	O_2	N_2	H_2O	SO_2
C	0.7620	2.031	8.777	2.794	—	6.746	—	—
H_2	0.0589	0.471	2.036	—	—	1.565	0.530	—
O_2	0.0897	—	—	—	0.090	—	—	—
N_2	0.0130	—	—	—	—	0.013	—	—
S	0.0063	0.006	0.027	—	—	0.021	—	0.012
Ash	0.0701	—	—	—	—	—	—	—
Total	1.000	2.508	10.840	2.794	0.090	8.345	0.530	0.012
O_2 in coal		0.090	0.388*	—	0.090	0.298*	—	—
		2.418	10.452	2.794	0.000	8.047	0.530	0.012
SO_2 as CO_2		—	—	0.012	—	—	—	0.012
Net weight, lb		2.418	10.452	2.806	0.000	8.047	0.530	0.000
Total weight, lb (combined products of combustion)								11.383

*Air and N_2 equivalents of O_2 in coal

TABLE 4 — COMBUSTION PRODUCT WEIGHTS WITH EXCESS AIR

% Excess air	0	20	40	60	80	100
	Combustion product weights, lb					
CO_2	2.806	2.806	2.806	2.806	2.806	2.806
O_2	0.000	0.484	0.968	1.452	1.936	2.420
N_2	8.047	9.653	11.259	12.865	14.471	16.077
H_2O	0.530	0.530	0.530	0.530	0.530	0.530
Total	11.383	13.473	15.563	17.653	19.743	21.833

sizing air and gas ducts, and selecting mechanical draft fans.

Particular attention should be given to the lowest heat value fuels where relatively large quantities of combustion products must be handled to furnish the required heat. For instance, Table 6 shows the performance of a 100,000 lb per hr, dual fired steam generator designed for 85 percent efficiency with pulverized coal and 80 percent efficiency with blast furnace gas when using fuels of the analyses covered by Figs. 1 and 6. To realize these efficiencies, not more than 30 percent excess air would be in the gases leaving the unit when firing with either pulverized coal or blast furnace gas.

The weights of air and combustion products, however, vary appreciably with changing fuel characteristics even though the steam rate remains constant. In fact, the volume of combustion products nearly doubles when using blast furnace gas. This is due to both the large amount of gas that must be fired to furnish the required heat and to the less favorable heat absorption that accompanies its utilization. Even though air and gas quantities normally do not vary as greatly as in this example, performance limitations are more likely to occur when design is predicated on a narrow range of fuel characteristics.

Fan Tolerance Factors

After establishing maximum air requirements, combustion product volumes, pressure losses, and draft losses for the complete unit from predicted performance, tolerance factors are added before selecting fans. For forced draft fans, 25 percent excess volume and not less than 50 percent excess pressure is considered good commercial practice. With induced draft fans, design usually is based on at least 20 percent excess volume and 30 percent excess pressure. These tolerances are incorporated to cover such circum-

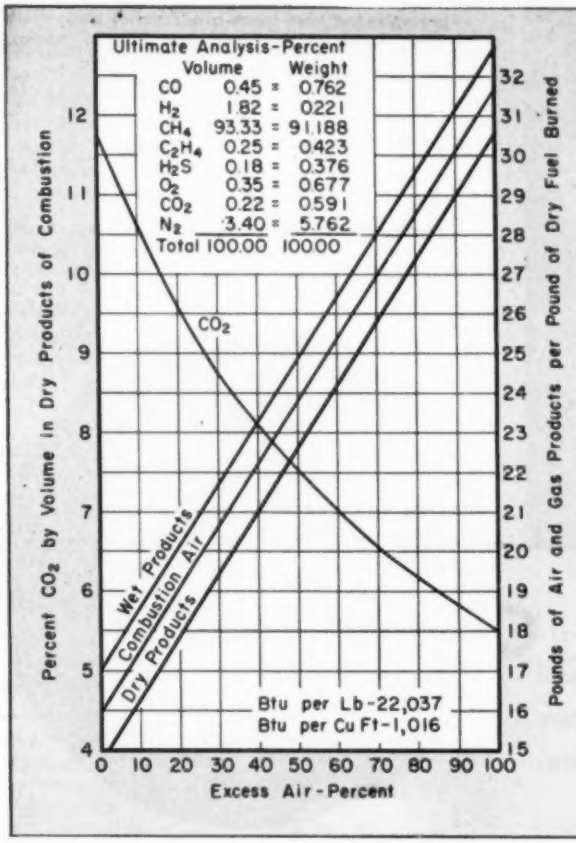


Fig. 5—Combustion data for the specified natural gas.

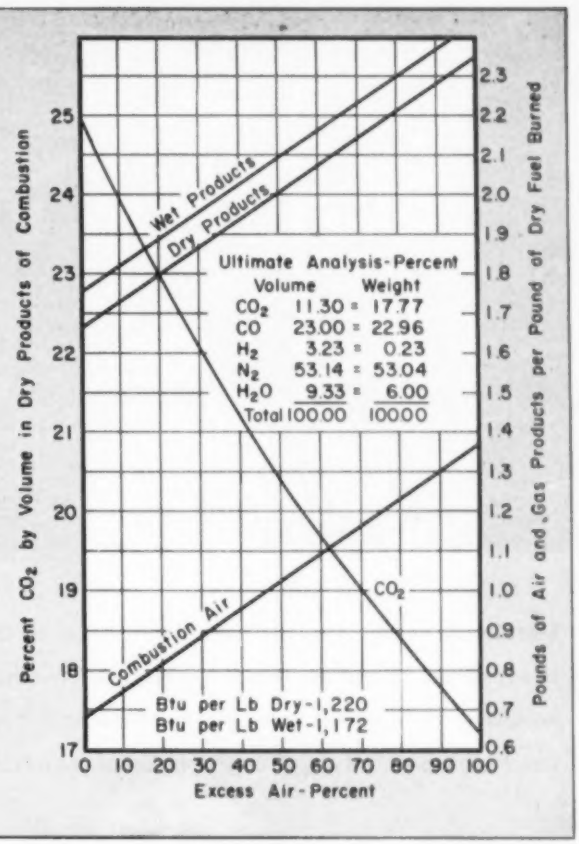


Fig. 6—Combustion data for specified blast furnace gas.

stances as: (a) abnormal leakage or infiltration in duct systems; (b) higher excess air volumes, air temperatures, or gas temperatures than anticipated; and (c) lower fan performance due to poor inlet and discharge conditions.

To realize fuel flexibility without sacrificing capacity, the complete steam generator and auxiliaries must include design features which satisfy the wide variation of air and combustion product weights that accompany changes in fuel characteristics. Although these facts are recognized by designers of steam generators, in some cases they are not evaluated properly when studying the addition of multiple fuel firing to existing boilers. Combustion graphs on the new fuels under investigation are quite useful in judging the suitability of existing ducts and fans.

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(1) *Combustion Engineering*, Otto De Lorenzi

(2) *Principles of Combustion in the Steam Boiler Furnace*, Arthur D. Pratt

(3) "Interpreting Stack Losses," INDUSTRY AND POWER, August 1953

TABLE 5 — DRY COMBUSTION PRODUCT VOLUMES WITH EXCESS AIR

% Excess air	0	20	40	60	80	100
	Dry product volumes, percent					
CO_2	18.07	14.97	12.78	11.15	9.89	8.88
O_2	0.00	3.57	6.10	7.98	9.44	10.60
N_2	81.93	81.46	81.12	80.87	80.67	80.52
Total	100.00	100.00	100.00	100.00	100.00	100.00

TABLE 6 — TYPICAL PERFORMANCE OF DUAL FIRED STEAM GENERATOR

Type of firing	Pulverized coal	Blast furnace gas
Steam rating, lb per hr	100,000	100,000
Combined efficiency, percent	85	80
Fuel burned, lb per hr	8900	108,000
Gas temperature, deg F*	325	485
Excess air, percent*	30	30
CO_2 in gases, percent	14.0	22
Combustion air, lb per hr	120,000	97,000
Combustion air, cfm at 70 F	26,700	21,600
Combustion products, lb per hr*	128,000	205,000
Combustion products, cfm*	40,200	77,700

*Leaving air heater.

Note: Operating conditions; 400 psig steam pressure, 600 F total steam temperature, 280 F feedwater temperature.

Hapman Conveyors

Feeders in cylinder block area convey chips from trough below floor level to a header above.

Conveyor flights and feeder drive unit are shown at junction with header. Feeders and header are below the floor in the cylinder head area.

Metal chip handling, until recently, has been an expensive manual operation. Dodge pioneered mechanical handling, and now has an extensive and efficient system which can be easily rearranged to meet requirements.

Dodge Mechanizes Chip Handling

IT WAS ONLY a few years ago that chip handling was a hand shovel process. Then—and even today in many metal working shops—the machine operator turned from his work every hour or so to pick up a shovel and scoop chips from the floor under his machine to a tote box or hand truck for delivery to a railroad car or briquetting machine.

Seven years ago, Chrysler Corp. Dodge Main Plant, in Detroit, installed their first mechanical handling system to carry chips from the cast iron machining areas to a briquetting plant. Their first major conveyor installation is still in use, but the extent of the handling system has been greatly enlarged. Many types of conveyors are involved in the system, but the basic plan is drawn about a layout of Hapman Tubular units. Through feeders and headers, all the cast iron chips coming from machining operations in the engine plant are carried to a main tubular conveyor along the outside of the building and through this conveyor to the briquetting plant. This over-all plan is well illustrated in the artist's rendering of the layout.

These tubular conveyors are excellent for handling cast iron chips, either wet or dry. Their design is such that the chips are given a positive movement by mechanical means, and yet they are handled within a pipe so that their motion does not stir up dust or interfere with production operations. Basically, these tubular conveyors are nothing more than a circuit of pipe through which runs an endless conveyor chain with disks, or flights, spaced every few inches. These flights pull the chips through the pipe from entry to destination.

This design permits considerable flexibility, which is one of this conveyor's principal features. The fact that it can go where any piping can go and occupies no more space than any pipe of the same diameter makes it particularly suitable for installation in older buildings and in areas where the metal working machines—the source of the chips—may be moved from one position to another from time to time.

Dodge Main Plant has taken advantage of these features. The major portion of the installation centers in one of the many multiple story buildings. The machines are replaced or relocated continuously to suit production requirements. The chip conveyor system is adaptable to such changes.

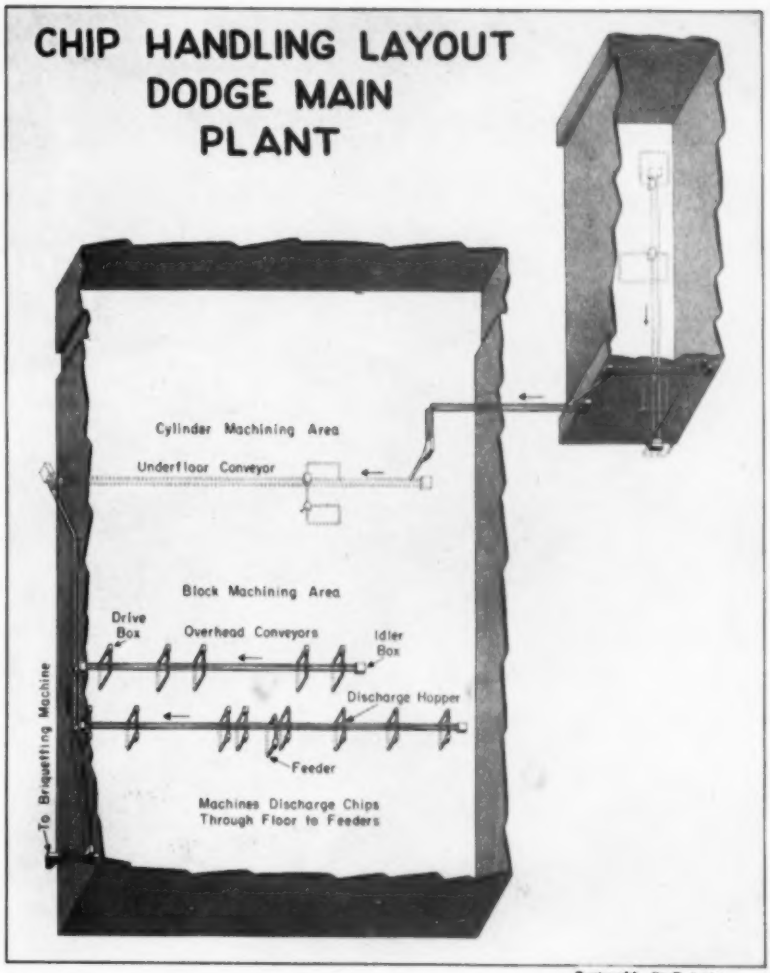
Layout

The first floor of the Dodge Main Plant includes an area 400 ft x 195 ft used for the machining of engine blocks and another area, 400 ft x 115

ft, for machining of cylinder heads. These departments are separated by the cylinder block assembly area. The heaviest machining is done on the cylinder blocks, and two 5-in. Hapman Tubular Conveyors are used as headers in this area. One of these runs nearly the full width of the building, 387 ft, while the other runs parallel to it but only two-thirds of the building width. Nine 3- and 4-in. tubular conveyors feed the longer header, and five feed the other. These two headers, in turn, feed into a 6-in. main chip conveyor, which was the original installation. This main conveyor runs 450 ft. outside the building from the cylinder head area past the cylinder block department and on to a hopper above the briquetting machine.

The headers in the cylinder block area are all overhead installations with the feeders being made as loops which pick up chips just below floor level and deliver to the headers above. This differs from the installation in the cylinder head area where the header is installed in a trough under the floor rather than in an overhead pipe. The conveyors feeding this header also are installed horizontally just below the floor. This layout permits them to pick up chips at any point along their perimeter rather than just along one side of their loop—the side running through the floor.

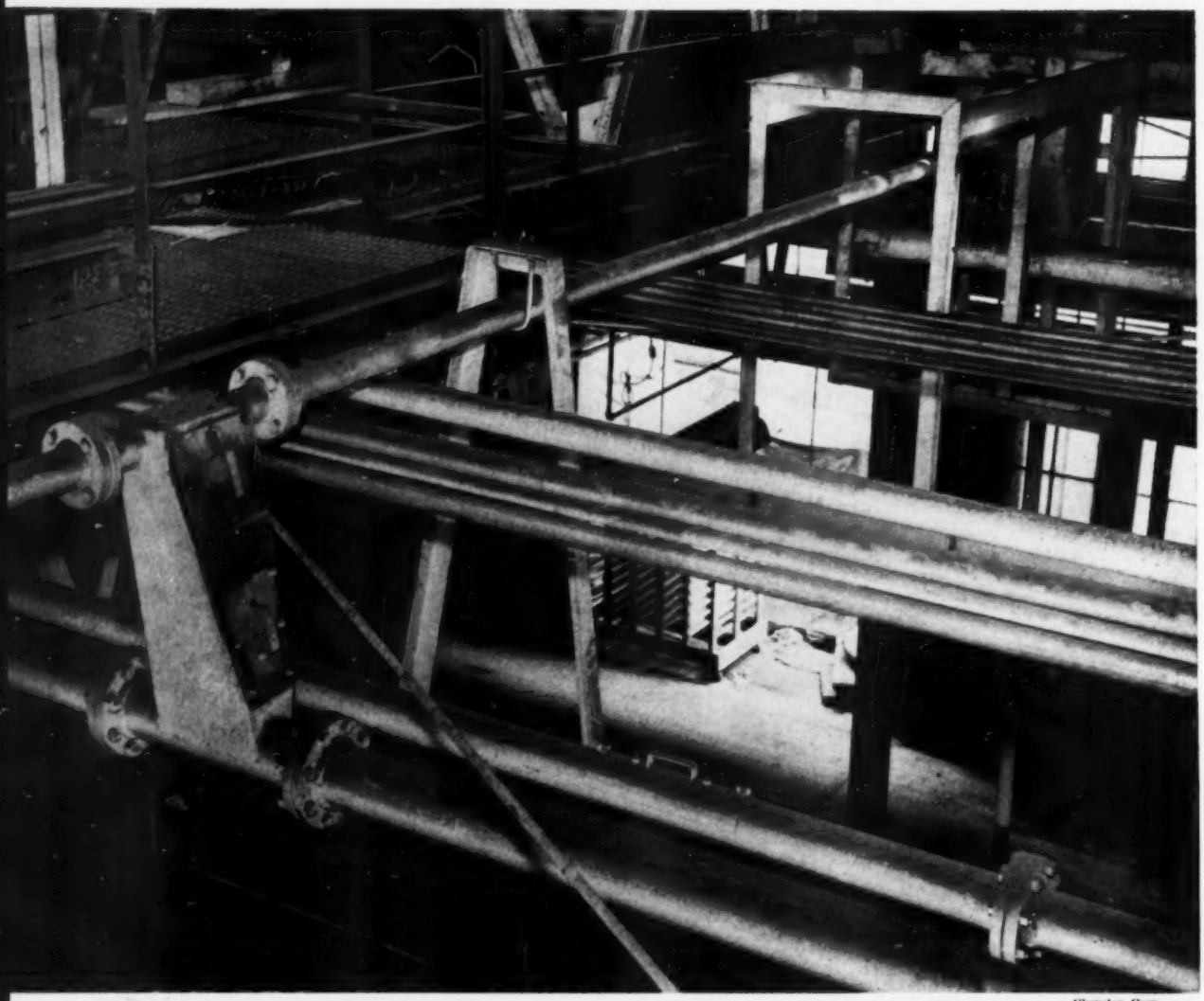
One other major system is included in the layout. A 6-in. tubu-



Bantowski—Staff Artist

Chrysler Corp.

Main conveyor, 450 ft long, receives chips from three headers in main plant and conveys them to briquetting machine.



Chrysler Corp.

Chips are picked up by conveyor running through floor below machines. They are raised to level shown by means of vertical risers (right background) and then move horizontally to discharge through an enclosed hopper in main headers.

lar conveyor brings chips from an adjacent building, used for machining crank bearing caps, exhaust manifolds, and clutch housings, to the conveyor in the cylinder head area. This conveyor picks up from three feeders, runs up about 20 feet to a higher level to clear tracks between the two buildings, and then dumps into a vertical pipe which drops the chips onto the trough conveyor.

Machines to Feeders

An interesting aspect of this chip handling system is in the variety of conveyor types used to get the chips from the machines to the tubular feeder conveyors. When machine tools are purchased, the manufacturers equip them with some sort of short conveyor to carry chips out of the machine to a discharge point.

Since Dodge uses machines from a number of machine tool makers, the types of conveyors used are almost as numerous as the manufacturers. Some of the machines use simple chutes to carry chips from the machining point to discharge. From the chute the chips fall through a grating and into a receiving hopper of one of the feeder tube conveyors. Larger and more complicated machines require longer and more positive conveyors. Several types use screw conveyors to get chips from the cutting area to the discharge point, while large broaches usually use chain drag conveyors. In some instances, short Hapman Tubular Conveyors are incorporated in the machines by the manufacturers and these convey chips from cut to discharge.

At one set of machines, used in finishing exhaust manifolds, a vibrating conveyor is used in this step of chip handling. Although these small vibrators work well when the machining operation is dry, they have not proved satisfactory in this plant when handling wet chips, which tend to stick to the conveyor.

Metallic Dust

As anyone familiar with the machining of cast iron knows, one of the problems is metallic dust. Even in wet operations fine cast iron dust is picked up in the air and settles on machinery and finished parts. This dust creates problems in subsequent

processing and testing operations. At Dodge Main Plant as much of this dust as possible is collected through hoods over the machines leading to a Centri-Spray Dust Collector. The collected dry dust also is fed into the tubular conveyor system and the wet sludge is sluiced from the bottom of the collector and discharged into an underground tank. A tubular conveyor then removes the sludge to waste boxes which are moved away on fork trucks.

Design and Maintenance

According to Dodge Plant engineers, the tubular conveyors handling cast iron chips do a creditable job when properly installed. Where the radius of a turn is less than six times the pipe diameter, a sprocket is required.

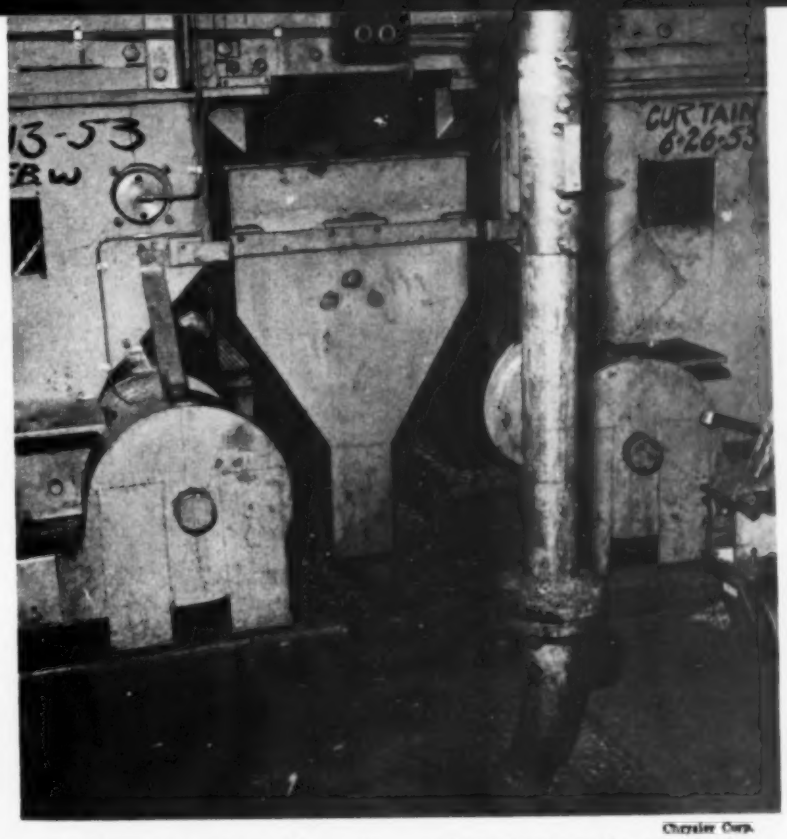
It is also wise to lay out the conveyors so that the material being carried does not pass through the drive unit. Though this is not absolutely necessary, it is considered good design.

These units require only small drive motors. The main 6-in. conveyor, incorporating a chain 900 ft long, uses a 3-hp drive. A 150-ft feeder unit requires only a 1-hp motor. The power required can be compared with the work done when it is recognized that the main conveyor handles 28 tons of chips per 8-hour shift.

Maintenance, other than the regular lubrication of chains and sprockets and normal attention to the driving motors, is minor. The chains and disks (which are Neoprene) wear well even when handling cast iron chips, and wear of the flights does not seem to reduce the capacity of the conveyors. Worn or broken flights are not usually replaced until the whole chain is worn. Only the chain in the main conveyor at Dodge has been replaced—after about seven years service—and the job took only 8 hours to complete.

Application

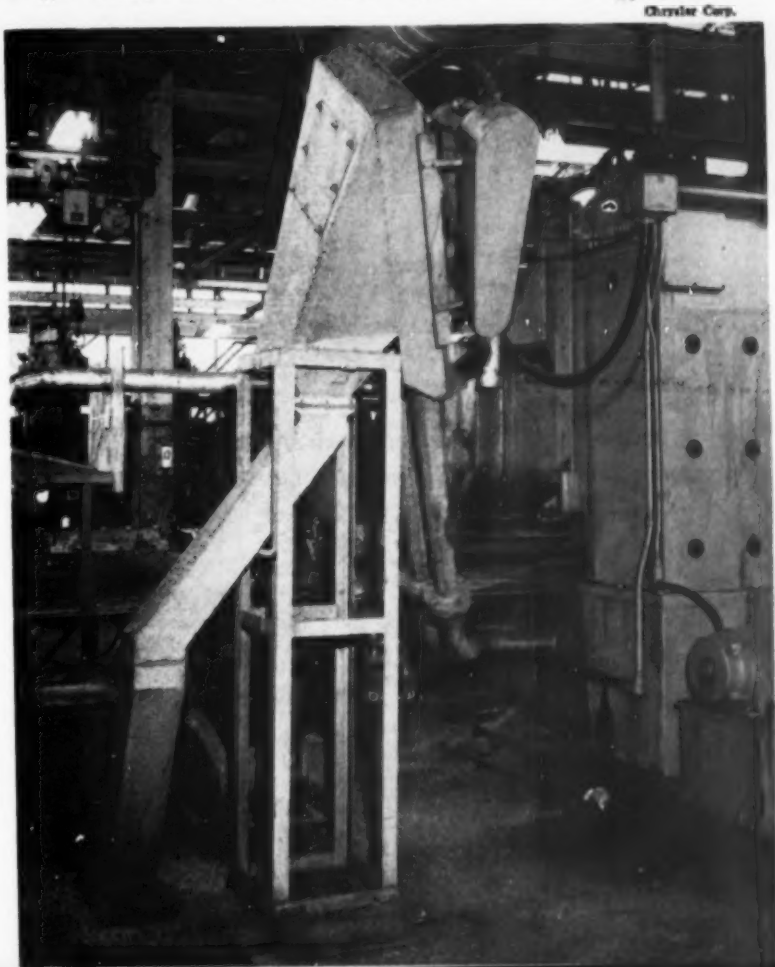
Tubular conveyors cannot be considered directly competitive in price with straight drag chain types. In a new building designed with straight runways for chip handling and where machines are put into a position where they are likely to stay, chips can be handled satisfactorily on less costly chain drag conveyors, but tubular conveyors are excellent in multi-story buildings in which a dust-tight system is necessary, in older areas not designed for chip handling, and wherever flexibility is required.

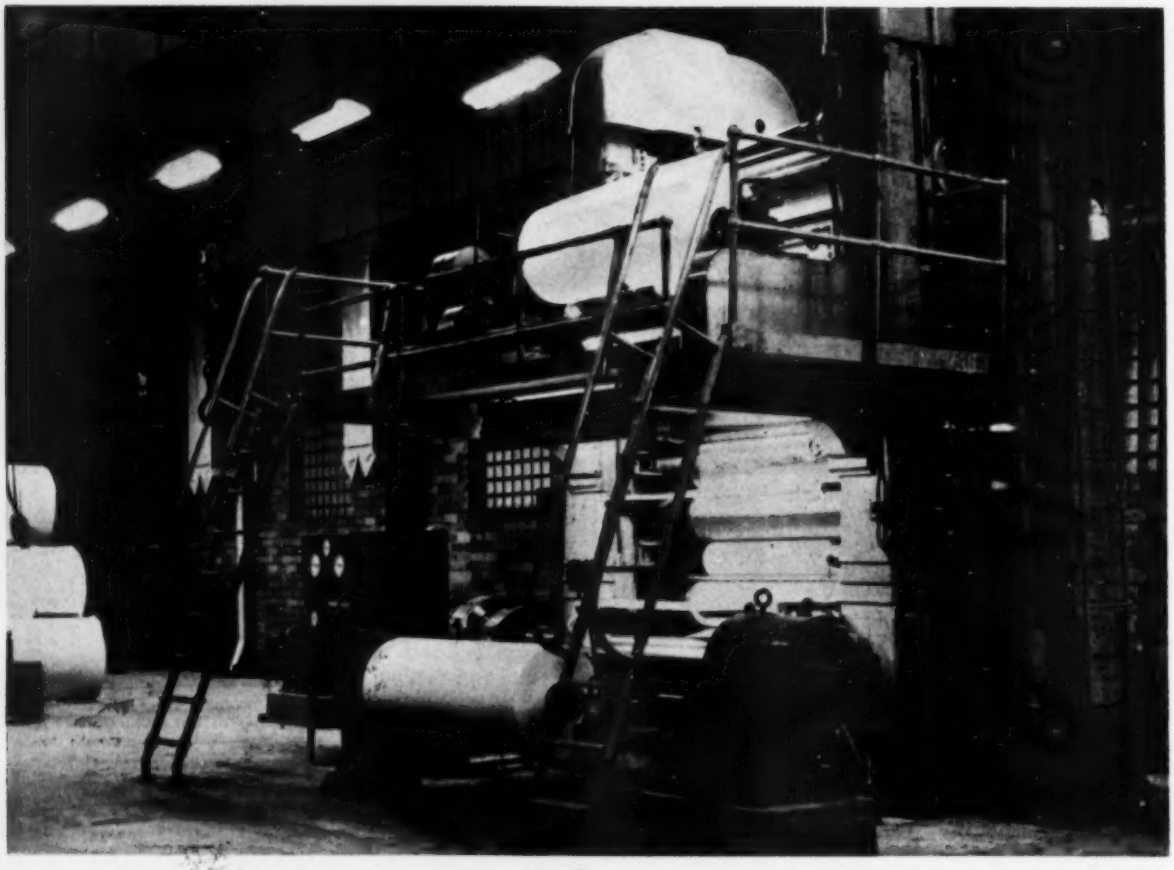


Chrysler Corp.

Manufacturers equip machines with a variety of systems for transferring chips. The broach, shown above, uses a simple chute, while the transfer-type drilling machine shown below employs a short tubular conveyor.

Chrysler Corp.





This 76-inch supercalender operates from 50 to 1800 fpm; it uses speed control for threading and production runs.

Electric Machine Drive Speed Regulating Systems

M. H. FISHER
Industry Engineering Dept.
Westinghouse Electric Corp.

The basic solution to speed control in one industry is often suited to other industries with but slight alterations; a few regulator types serve the bulk of industry's needs.

BETTER PRODUCTION is probably more directly related to the development of better methods of control than to any other factor. Whenever an advantage in cost, quality, or rate of production is realized, chances are that a new or improved control scheme is at least partly responsible. In the field of electric machine drives, the electrical regulator provides continuing impetus toward better, cheaper, more quickly made products.

No regulator need be restricted to a particular industry. Although the manufacturing processes of two industries may radically differ from each other, the drive regulating problems often are quite similar. For instance, the regulator for a single-motor paper machine drive is used, with slight variations, on the drive of a cellophane casting machine which extrudes liquid cellulose in sheet form, passes this sheet through a fixing process, and finally winds it on a reel. Similarly, the speed regulator used to control a machine tool might be applied to a calender or to an elevator drive.

The field of regulator application is extensive. The reason for this widespread use is the fact that regulators can control voltage, current, power, speed, torque, tension, or any other quantity that can be translated into a signal voltage or current.

Essentially three types of regu-

lators are used in industrial regulating systems: rotating, magnetic amplifier, and electronic. Each is gaining a fairly well-defined field of application, although there will always be some overlapping. Power handling capacity, efficiency, response time, maintenance factors, and cost are major considerations when applying any of the three types. In some cases, characteristics which are peculiar to the process, such as space and weight limitations, may be the deciding factors.

Speed Regulators

The most common regulator is the speed regulator. Four basic types of industrial speed regulators are used, and a convenient way of classifying them is according to the approximate accuracy of each and according to the cueing signal used: ± 3 percent—main generator voltage; ± 1.0 percent—motor counter electromotive force; ± 0.5 percent —pilot-generator voltage; ± 0.1 percent—tachometer frequency.

The selection of a speed regulator depends, ultimately, upon the required accuracy and the nature of the process. For example, a metal planer needs a regulator which will make sure that the cutting speed is maintained within plus or minus one percent. A counter-electromotive-force speed regulator is suitable.

Because the d-c driving motor speed is proportional to the counter-electromotive-force of the motor when the field strength is constant, the speed can be measured by use of armature voltage and current signals. When the generator voltage is compared—in the regulator—to the sum of a reference signal plus the IR drop in the motor-generator armature loop, the motor speed can be maintained accurately regardless of load variation. It is possible to obtain equally successful results with a magnetic-amplifier counter-electromotive-force regulator.

Pilot-Generator Regulators

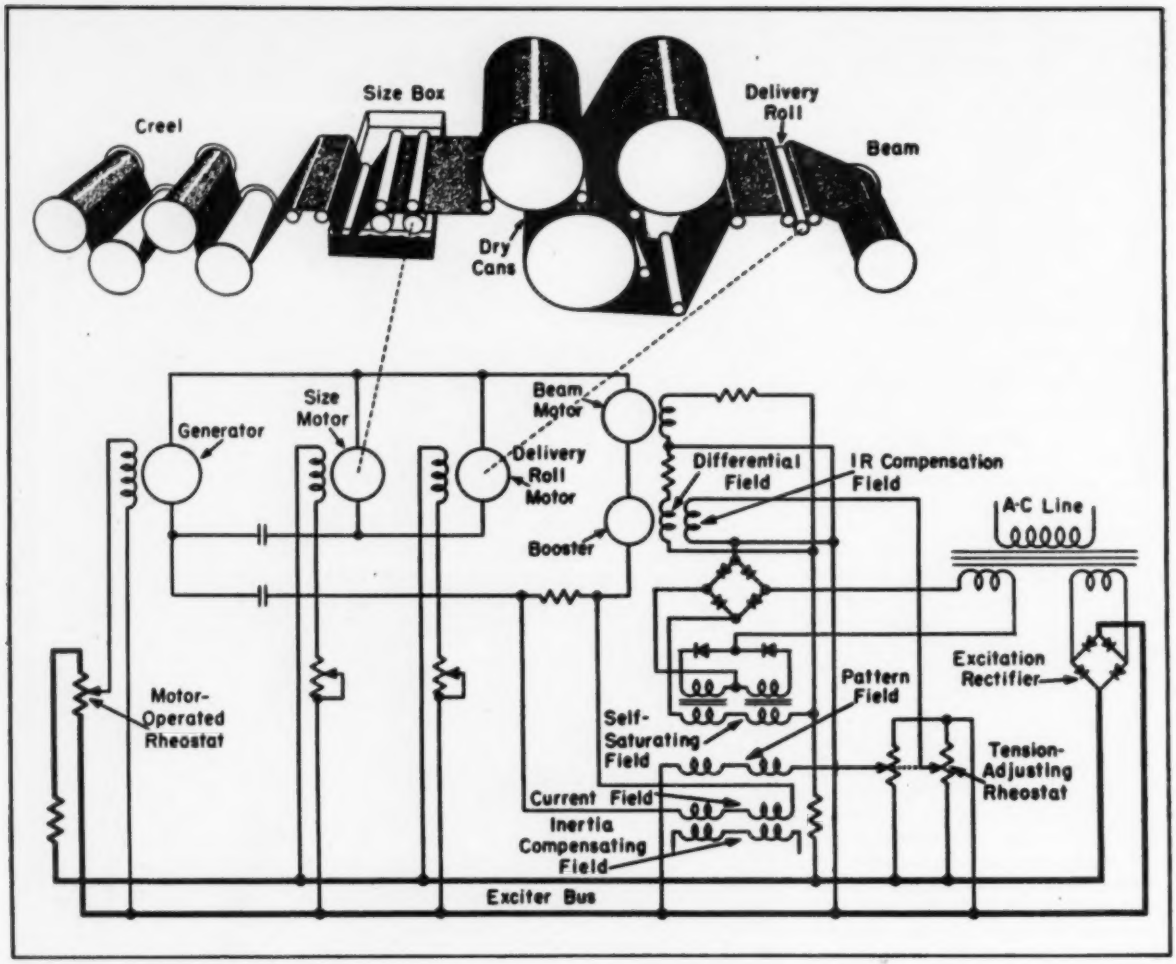
Many continuous processes—such as manufacture of cellophane, paper, and rubber products—require a more accurate regulator, capable of holding constant speed over long periods to insure minimum variation in quality. Speed also must be uniform during load changes.

A regulating scheme consisting of a pilot-generator feedback circuit and a rotating exciter regulator or a magnetic-amplifier regulator provides an accuracy of ± 0.5 percent at top speed. This system maintains constant-speed accuracy over the operating range because it is sensi-

This packaged magnetic-amplifier multi-motor drive regulator embodies the advantages of pre-wiring and ease of servicing by regular plant personnel.

TABLE 1 — SPEED REGULATORS

Cueing signal	main generator voltage	motor counter-emf	pilot generator voltage	tachometer frequency
Approximate accuracy at top speed	±3.0%	±1.0%	±0.5%	±0.1%
Typical drive applications	hoists blooming, slabbing, and plate mills (main and auxiliary drives) bulk unloaders	machine tools elevators winders super-calenders electric shovels tandem cold-reduction mills high speed steel mill reels	paper machines wind tunnels rubber and plastic calenders cellophane and rubber extruders tire-testing machines rod and merchant mills flying shears slitting lines	paper machines man-made fiber machines



Main job of regulator on the textile slasher machine is to maintain uniform yarn tension as beam diameter increases.

tive to a fixed change in pilot-generator output voltage. This output voltage is proportional to speed. Thus, if the regulator is sensitive to a 0.25-volt change, which, in turn, is proportional to a 4-rpm change, then the regulator holds ± 4 rpm over the complete range of operating speeds.

To minimize speed changes over a long period (24 hours or more), special provision must be made to reduce the effects of ambient temperature variation and exciter voltage variation. The speed regulator for a cellophane casting machine uses a self-compensating pilot-generator circuit to minimize these effects. The generator itself is a special machine having restricted armature end play plus frame and pole steel to reduce hysteresis and residual magnetism effects. It is operated on the straight part of its magnetization curve so that its output voltage changes in exact proportion and direction as does its field current. The field is in series with the speed-control rheostat so that changes in excitation affect the cue voltage across the rheostat and the output of the pilot generator by proportional amounts. Thus, the circuit is self-compensating and assures constant speed control over extended periods of time.

Test Machine Regulation

Speed-regulating requirements of a tire- and brake-testing machine require the use of a special speed regulator similar to that used for cellophane manufacture but with further refinements. Manufacturers must test their tires and brake linings under controlled conditions similar to those encountered in actual operation to be sure that the tires meet specifications and standards for which they are designed.

These tests lead to special control features. To save time, decelerations are often stopped at one-quarter speed (stored energy, 1/16th of maximum), and the road wheel is brought up to top speed again. During deceleration the power is off and the main line contactor is open. Since the main line contactor is closed before the drive comes to a complete stop, the generator voltage must equal that on the terminals of the motor which is now acting like a generator at no load with output voltage proportional to speed. This is accomplished by feeding the voltage across the main line contactor into the magnetic-amplifier regulator, which maintains the generator voltage at a value that is safe for closing of the contactor.

Prolonged road tests are conducted at low speed to simulate operation of tractors and very heavy military vehicles. With these tests, speed regulation at values as low as 4 percent of top speed are provided by the speed regulator with

loadings at 100 percent load or less.

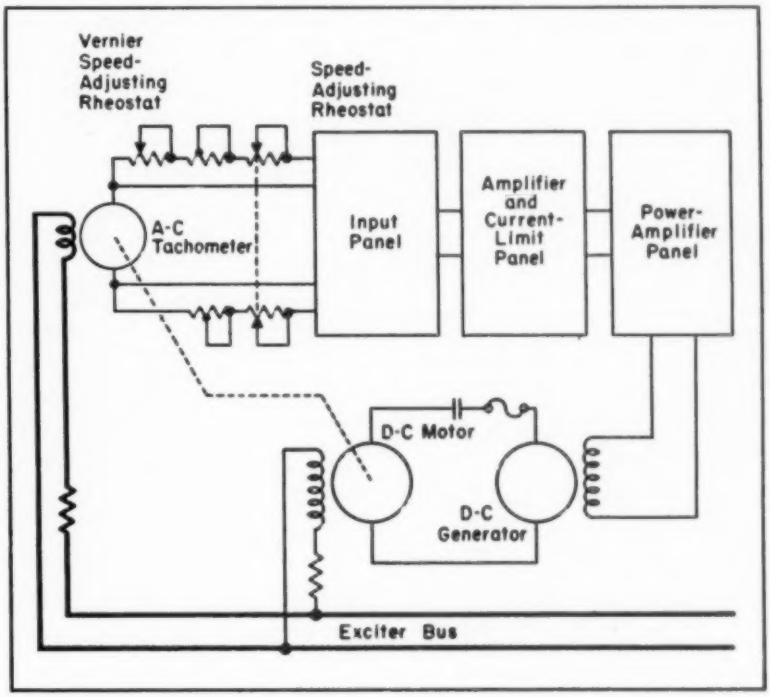
Regulators With Current Limit

A high-inertia load controlled by a speed regulator often requires current-limit protection to avoid overloading both the electrical and the mechanical parts of the drive. Application of such control to an ordinary crane hoist is typical, although it can be applied with equal success to the hold, close, and trolley functions of an ore-handling tower drive, a vertical-lift bridge, a paper winder, or any other drive having similar characteristics.

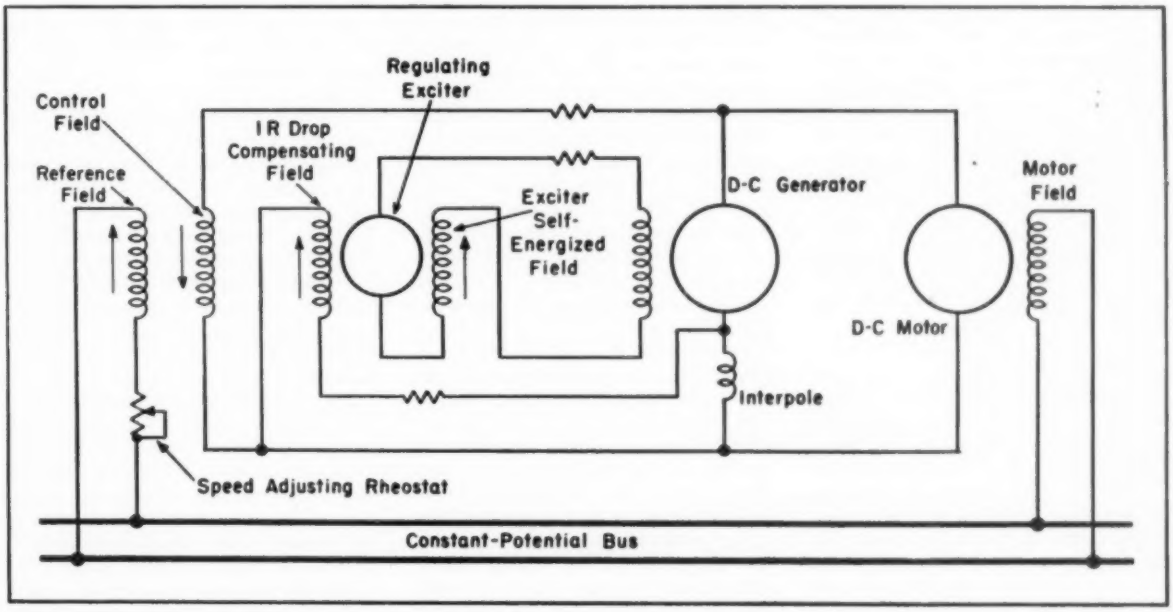
Reversible Drives

When the drive does not require reversible control, a magnetic-amplifier regulator can be used to furnish excitation to the d-c generator. When dealing with a reversible drive that requires sizable excitation for its generator, a rotating exciter regulator lends itself to the reversing requirement without sacrifice in efficiency or performance. For example, if a magnetic-amplifier regulator were used to supply the generator field for reversing service, either two sets of generator fields (each good for 100 percent excitation) or a reversing magnetic-amplifier scheme would be necessary. The first method is prohibitive due to the extra cost for a special generator. The second method results in a regulator that has reduced efficiency at maximum output. This is in contrast to a rotating exciter regulator which is equally efficient at maximum output in either forward or reverse directions.

A hoist drive does not require extremely accurate speed regulation, so an ordinary voltage regulator is used to obtain reasonable speed-load characteristics. If more accurate speed regulation is required, a



Tachometer frequency regulators provide extremely accurate speed control; this circuit is used with drives for machines in man-made fiber processes.



Motor c-emf regulators are especially suitable where uniform speed must be maintained on individual machines.

counter-emf speed regulator can be used. The rotating exciter regulator is provided with a reference field—adjusted by the operator—and a differential voltage field which reflects the generator voltage. These two fields furnish the voltage regulation intelligence to the regulator. Two additional regulator fields provide current-limit override for both acceleration and deceleration of the drive. Each field is excited from a current-limit magnetic amplifier. Since the fields require less than 50 watts excitation, the use of two small magnetic amplifiers—one for acceleration, the other for deceleration—adds little in overall cost or power consideration.

The current-limit magnetic amplifiers and some unique circuitry can be used to give nearly vertical current-limit cut off. Reference voltage, bias, and current fields combined with inherent characteristics of the magnetic amplifier provide the sharp current-limit cut-off performance in the hoist drive.

Constant-Horsepower Drives

In processing industries—such as paper, printing, plastics, textile, and steel—material is often unwound from a reel, passed through one or more sections of the processing machine and finally rewound on a reel or beam. Typical of the drives for these processes is the slasher drive in the textile industry. The slasher is used to apply a starch sizing to the warp yarn before it enters the loom to be woven into cloth. In the slasher, yarn is removed from several warper beams assembled in a creel. From the creel, the many "ends", or strands of yarn, are passed through a sizing solution, then through squeeze rolls to remove some of the solution. The wet yarn is dried, separated, passed over a cloth-coated delivery roll, and ultimately wound on a core-driven loom beam. In the typical multimotor slasher drive, two motors carry the yarn through the machine and a third winds the yarn onto the loom beam.

Tapered Tension

The loom beam-drive motor should be capable of operating through a 5 to 1 beam diameter change and from a 5 to 100 yards-per-minute yarn speed. Since this warp yarn is wound thread upon thread, tension must be correctly held to prevent the oncoming yarn from being pulled down between the outer layers of previously wound yarn. Constant or slightly tapered tension on the yarn being wound is desirable. Tapered tension wraps the core tighter than succeeding wraps and so tends to reduce the number of strands pulled beneath the lower layers.

Slasher Drive

The slasher drive uses a direct-current system to achieve the smooth acceleration and deceleration required to operate over an adjustable-speed range according to the type and size of yarn being processed. Stabilized shunt-wound d-c motors are used to drive the size rolls and delivery roll and an adjustable-speed motor holds tension at the beam.

Tension in the beam is regulated over a five-to-one reel-diameter range by a magnetic amplifier and a booster generator. The magnetic amplifier regulates current in the beam motor armature circuit by controlling its field. This results in essentially constant tension at the beam regardless of the beam diameter. Also, by providing an auxiliary field on the IR-drop compensating booster, the magnetic-amplifier current regulator can furnish excitation to the booster in a direction to reduce the motor terminal volts as the beam builds up. Thus, the feature of tapered tension can be attained.

Tachometer Frequency Regulators

When extremely accurate speed regulation is required, such as for paper-manufacturing or for a man-made fiber process, an electronic regulator is used to maintain speed based on a measured frequency. In such a system, an a-c tachometer is coupled to the shaft of the motor to be regulated. This tachometer may be an inductor type, having both the d-c excitation winding and the a-c armature winding in the stationary member. The motor has 120 tooth-like poles that cause the tachometer to generate a frequency of 1 cycle per second per rpm or 1200 cycles per second at 1200 rpm.

The output signal of the tachometer is fed into the input section of the electronic frequency regulator, which delivers this signal into a precision resistance-capacitance bridge. The bridge balance frequency is determined by the setting of a rheostat in two legs of the bridge. The output of the frequency bridge is rectified and applied to the input of the voltage amplifier as a d-c signal voltage. When the bridge is balanced at a frequency determined by the setting of the speed-control rheostat, no signal voltage is applied to the amplifier. If the frequency of the a-c tachometer generator departs from the set value, the frequency bridge becomes unbalanced and applies a signal voltage to the amplifier. The polarity of this signal voltage depends on whether the frequency is greater or less than the balanced frequency.

The amplifier signal voltage applied to the control bridge in the power-amplifier panel determines the amount of voltage applied to the d-c generator shunt field. Polarities are adjusted so that when the a-c generator frequency is too low, the voltage applied to the d-c generator field is increased. This increase in generator voltage speeds up the d-c drive motor and raises the frequency of the a-c tachometer generator to the desired value. Reverse action occurs when the d-c motor speed is too high.

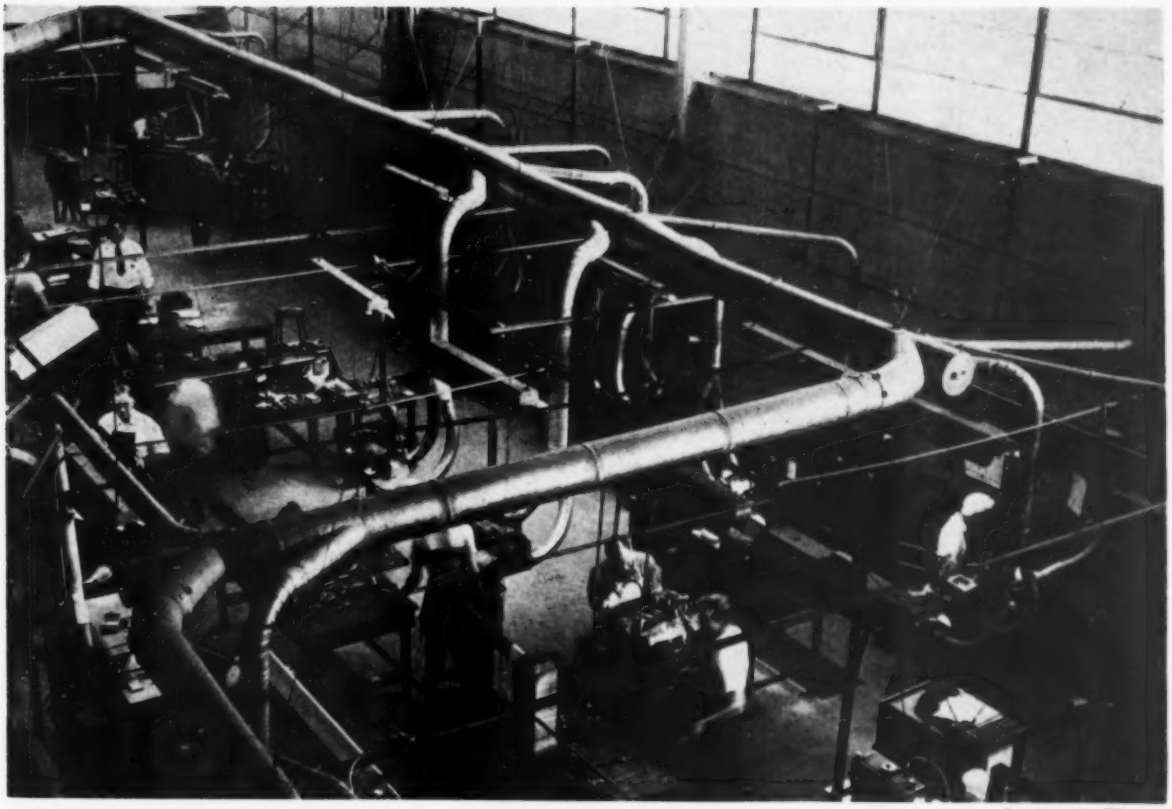
Anti-hunt circuits stabilize the regulated system. The regulator responds to the rate of change in generator terminal volts so as to oppose variations caused by changes in speed of the pilot generator. Acceleration and slow-down are controlled either by a motor-operated rheostat or by a current-limit override in the amplifier panel.

Packaged Units

Such drives as the slasher drive are commonly built in package form. This means that the a-c control, m-g set, booster, and d-c control (including the tension regulator) are built into a common cabinet and are factory-wired and tested. Thus, a minimum of connections need be made by the user, and the chances of making wiring mistakes are almost eliminated.

These regulators indicate the varying degrees of complexity and control accuracy of applications. Particular attention must be given to fundamental physical quantities of the systems in which a control scheme is to be adapted. In addition to the requirements on steady-state accuracy, there must be consideration of differences in inertias, inherent time delays, power levels, accuracies desired, and cost justifications.

The more accurate regulator usually is more complicated, and more expensive from a first cost and maintenance standpoint. Because of this, a study of each regulating problem should be made before the regulator is selected, and the simplest regulator that will do the job adequately should be used. A precision regulator should be applied only when a precision job is required.



American Air Filter

A well-designed exhaust system is equipped with "dead end caps" to allow easy accessibility for cleaning duct runs.

Maintenance of Exhaust Systems

JOHN G. LISKOW, Chief Engineer Dust Control Division
American Air Filter Company

AN EXHAUST SYSTEM is a necessary and important part of any dust collecting installation. It must be well designed so that it will not only convey the material safely and efficiently but it should be low in first cost and require a minimum of maintenance work.

Original design strongly influences the amount and type of maintenance required for exhaust systems. Original design takes into account such factors as the characteristics of the material to be handled (sticky, abrasive, toxic, oily) and these characteristics in turn determine the type of hood or enclosure required for the system.

Some processes cannot be tightly hooded and therefore require large exhaust volumes to handle light dust loadings. Others are inherently tightly closed and higher dust loadings can be handled with smaller volumes of air. For example, where abrasive material is being handled, there is a tendency to erode blast gates or orifices so that a well-designed system for such materials should use a balanced air flow in all branches, thereby avoiding the necessity for blast gates.

Future requirements also enter into proper design and can considerably influence maintenance costs. A system cannot be properly operated and maintained when branches are indiscriminately added. These additions destroy initially planned air balances and change velocities so that plug-ups and other faults are multiplied. Wherever possible, future requirements should be estimated and the original design so arranged that additional hoods and branches can be installed without disturbing the air flow balance. However, it is not always possible to estimate future requirements. From a maintenance point of view it may be found advisable to install a separate main for additional hoods rather than try to tie them into the old system.

Cleanout provisions are necessary. Good design can minimize the number of cleanouts required, but it cannot completely eliminate them. When an adequate number of cleanouts are built into the system, maintenance work is simplified.

Types of cleanouts in common use are the slide door type, the hinged

American Air Filter

Dust, from a series of polishing and buffing jacks, is picked up at the machines by feeders connected to the main system.

access, and the dead end cap. These should be so placed that they allow all of the header or main to be inspected and cleaned as required. They can be located in either the side or the bottom of the duct work. The side cleanout has the advantage of allowing inspection and cleaning without excessive spillage on machinery or personnel below.

Control Check System

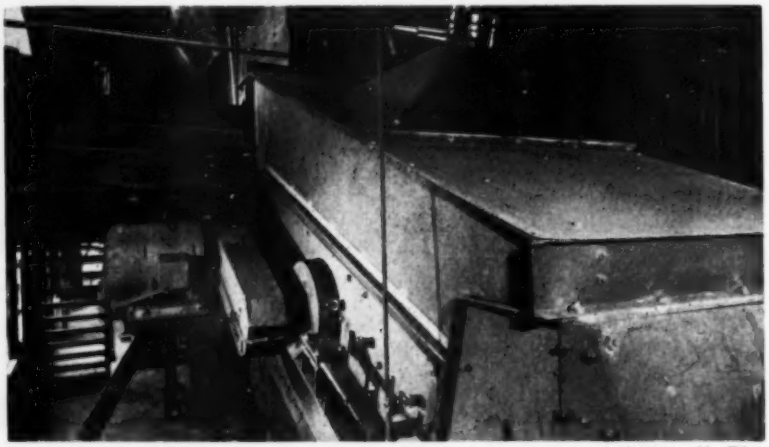
The plant maintenance department cannot properly determine the condition of an exhaust system unless they know how the system is to perform. After a system has been installed, a data sheet should be prepared for the maintenance department and it should include the following basic information:

(1) Location of the system can be indicated by using bay or column numbers, machine numbers, or departments. Manufacturers' machine and equipment operating and installation data are recorded for maintenance reference. This information also helps in obtaining repair parts.

(2) Operating data. The design volume on each hood, branch, or connection is recorded and the total volume, pressure, horsepower, and rpm on the air mover noted.

(3) System characteristics. Pressure readings are taken at all check points after the system has been balanced. These figures are compared when checking performances at future scheduled dates.

Strangely enough, check points are frequently "lost." By painting a circle of white or yellow paint around the hole and giving it an identifying number, this difficulty can be rectified. With numbers on all check points, the maintenance crew cannot knowingly miss one.



American Air Filter

A tightly enclosed hood collects coal dust from a vibrating coal screen.

Check points can be a 1/16 in. hole drilled approximately a foot from the hood of each branch. However, it is better to use a short length of small copper tubing fastened over the drilled hole. This gives a more accurate reading since the rubber tubing to the U-gage can be slipped over the projecting nipple for an accurate determination of negative pressure. A further refinement is the use of a small brass pet cock in place of the copper tubing. This allows a gradual opening to the U-gage so that there will not be any loss of the liquid if there is a high suction at the point being tested. It is, however, important that the duct be smoothed on the inside after the hole is drilled or the tubing or pet cock is inserted, otherwise it will be impossible to get a true reading.

These pressure readings are a guide to system maintenance. When employed at all hood entries, branches, and collection equipment inlets and outlets, they show not only the requirements for maintenance but indicate plugged collection equipment, slipped belts on exhausters, and many other minor ailments that can be corrected before they become major and lead to actual breakdown of equipment.

Week-end work can be largely eliminated when check points are built-in features of a dust collection system. The system card and a U-gage can discover troublesome conditions with no shutdown during regular working hours. A comparison of the original readings with those made periodically will point out any need for maintenance work. When one hood check point or the check points on one branch show lower pressure readings, while other

branches give a higher reading, a plug is indicated. This plug can be located and removed for it is obvious that it must lie somewhere between the lower reading points and the air mover. The general condition of hoods, pipe hangers, and duct work can be visually determined at the same time of the reading.

It is important that hoods be properly replaced after maintenance work has been completed. Sometimes, the crew working on the production equipment does not feel responsible for the dust collection system, and therefore is not careful in making hood replacements. Here again design is important, for a hood which is correctly designed can be replaced in only one way—the correct way. Its removal and replacement should also be simple. The standard grinder hood is an example of proper design in this respect. It can be opened for wheel changes in a few seconds and easily replaced. There is much work to be done on the improvement of hood design for other equipment.

Keeping Ducts Clean

In cleaning duct work, the small light gage type can be taken down by removing the drawbands. They can then be emptied into a hooded container if the material being collected in the system is dry. If material containing oil mist or a condensate must be cleaned from duct work, spray washing may be required. This is generally satisfactory only for short runs of duct.

Condensation in pipes is often a problem and no sure preventive method has been found. Different plants have tried lower velocities, higher velocities, insulation, heating of the ducts, and built-in scrapers or nozzles. Perhaps the best solution is to keep runs from moisture producing operations as short as possible and mix this high humidity air with warm dry air from some other nearby operation. Short runs mean that duct work can be easily removed and washed out. It has also been found that strip heaters can be installed on the duct work to warm it before air is pulled through. Auxiliary heated air has also been introduced to the duct section in a few plants, but it is expensive.

The check point method is the very basis of a good maintenance system, for without check points it is not possible to determine where and when maintenance is needed. Permanent check points will show the location of plugs or other troubles so that only part of the system need be shut down for maintenance work. Utilization of this permanent check point and record system results in better operation and reduced maintenance cost and provides a quick and easy means of keeping the entire exhaust system in satisfactory operating condition.

DUST CONTROL SYSTEM CHECK SHEET

System No. ..... Location ..... Dwg. No. .....
Date started ..... (Col. No.) (Bay)
Equipment exhausted .....
.....

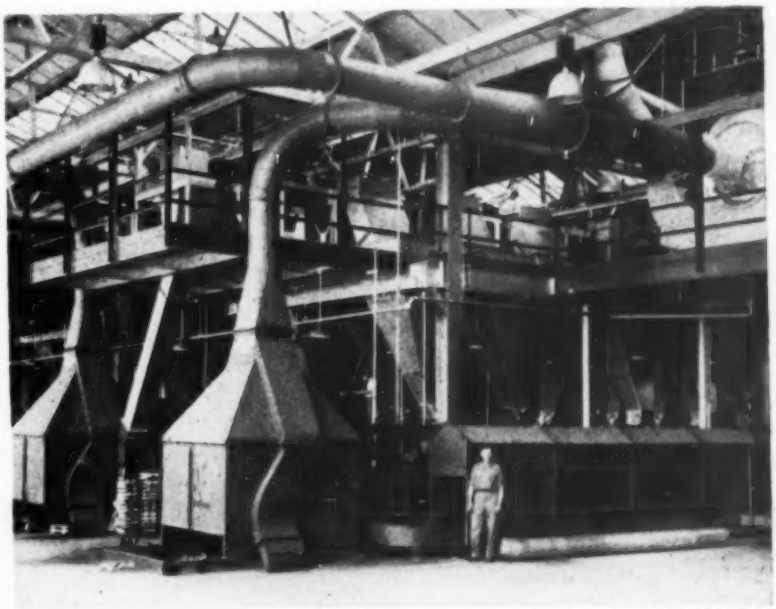
Collection equipment:
Make ..... Type ..... Size ..... Arr. ..... Serial .....
Miscellaneous data ..... Design rpm .....

Exhauster:
Make ..... Type ..... Size ..... Arr. ..... Serial .....
Shaft diameter ..... kw ..... Design rpm .....
Design bhp ..... Actual bhp ..... (at start up)

Motor and base:
Make ..... Type ..... Enclosure .....
hp ..... rpm ..... Volts ..... Phase ..... Cycle .....
Shaft diameter ..... kw .....

V-belt drive:
Motor sheave pd ..... No. grooves ..... Belt section
Bore ..... kw .....
Exhauster sheave pd ..... No. grooves ..... Belt section
Bore ..... kw .....

System data Check point No.	Design volume (cfm)	Design pressure (psi)	Balanced system (psi)
1			
2			
3			
etc.			



American Air Filter

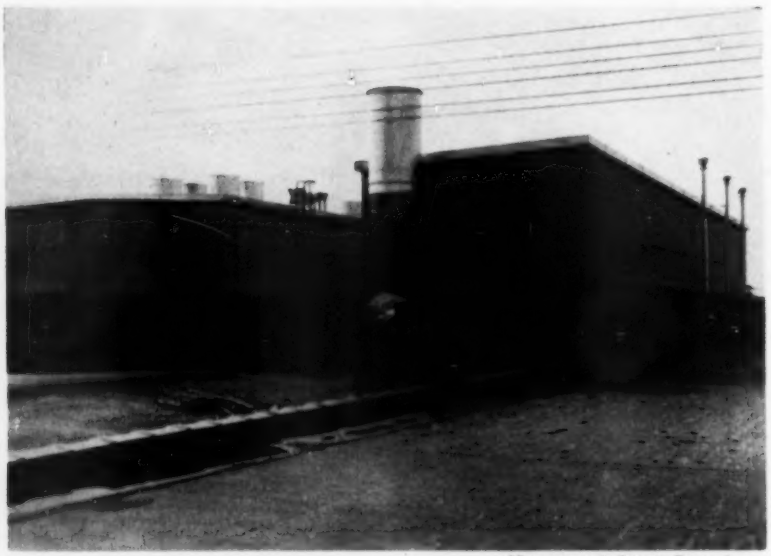
Semi-enclosed shakeouts in this production foundry have removable panels.

Minnesota and Ontario Paper Co.

The master thermostat regulates warmth in the building by computing the inside and outside temperature differential.

Waste Heat Economizers

Here's how a large paper mill saves on fuel by utilizing the waste heat from its paper processing machines.



Minnesota and Ontario Paper Co.

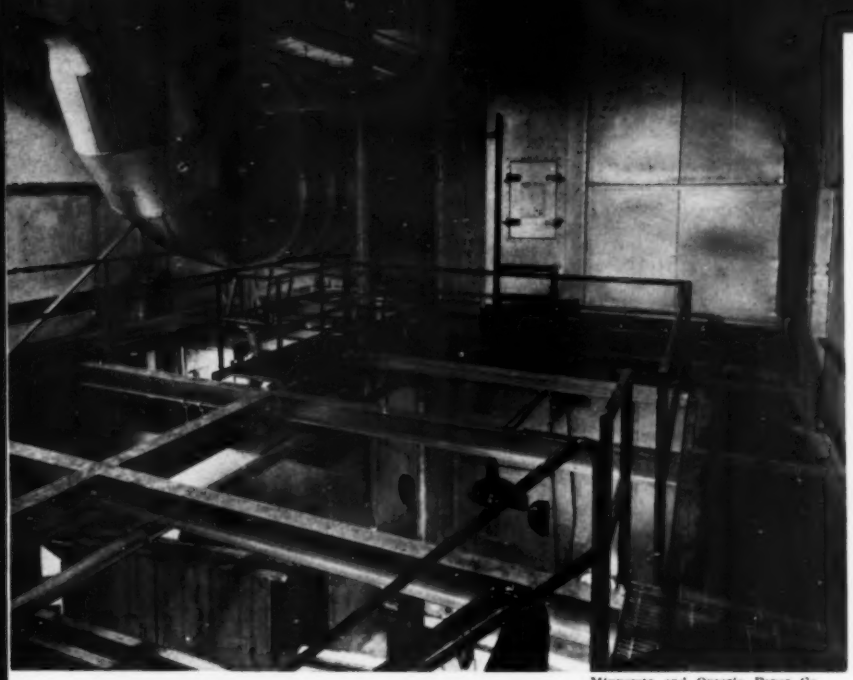
The small structures attached to the penthouses on top of the paper machine buildings are temporary screens which will be removed and filters installed.

BRINER ECONOMIZERS were recently installed as a part of the heating and ventilating equipment in the International Falls plant of Minnesota and Ontario Paper Company. The old equipment, a combination of wet and dry systems, had become obsolete and beyond economical repair, and the waste heat from the paper machines was no longer being efficiently utilized.

The new Briner economizers consist of a series of corrugated sheets of stainless steel with alternated spaces for vapor and for fresh air. The fresh air enters large intakes in the walls of penthouse-like structures that were built on the plant's roof. Fans draw this cold air into the economizer, where it enters coils. These coils are in turn heated by the hot, vapor-laden air from the paper machines. After heat has been transferred, the fresh, warm, dry air is blown through ducts to the rooms.

Also incorporated in the economizers is a water heating unit. A fine spray of water is injected into the flow of warm air as it leaves the economizer section. The water is heated and later used for shower and stock water. These spray chambers are located underneath the economizer and exhaust fan on each unit. The economizers heat about 1100 gallons of water a minute.

With the installation of the economizers, employees have an auto-



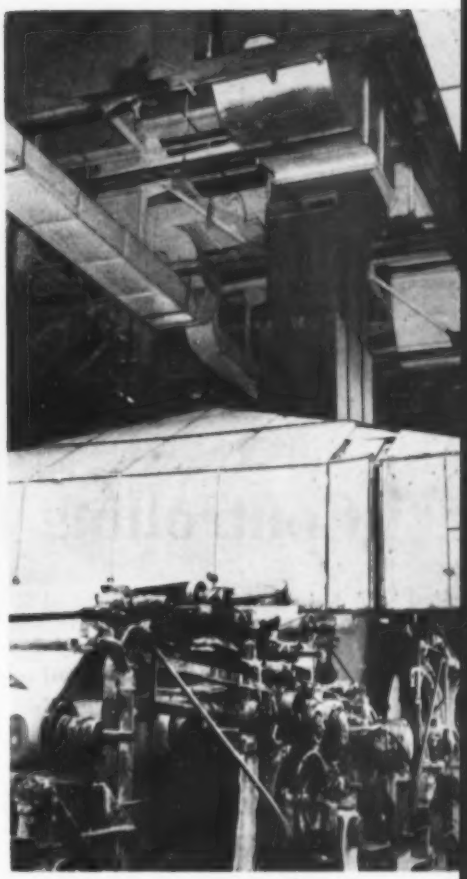
Minnesota and Ontario Paper Co.

A view of the Briner economizer and exhaust stack inside the penthouse.

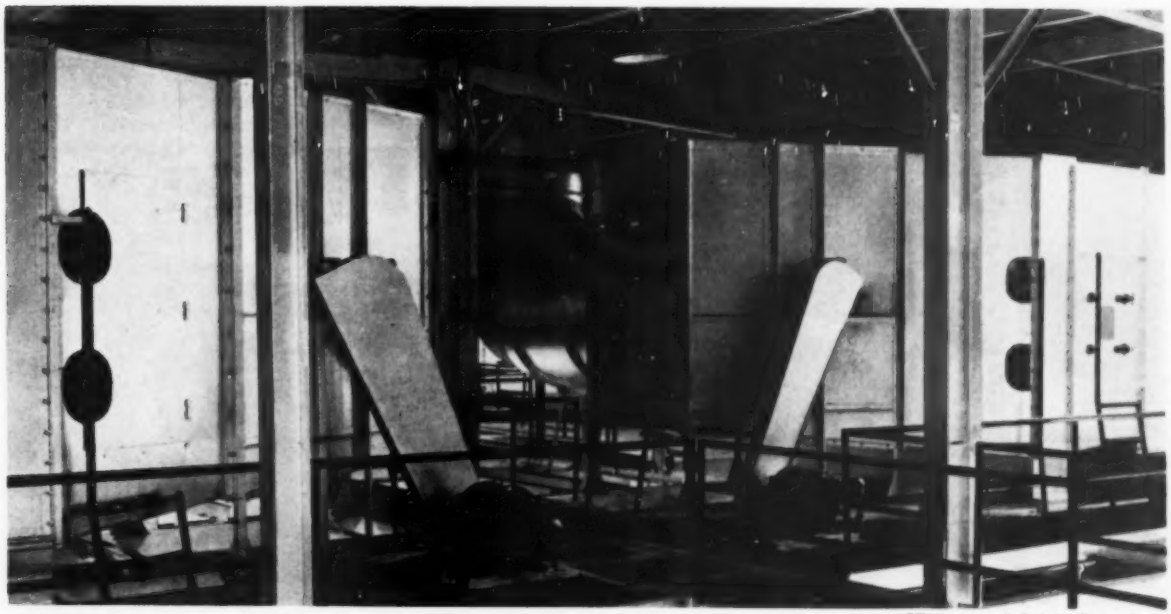
matically controlled heating and ventilating system. Each of the 10 units has a master thermostat and a sub-master thermostat. These thermostats react to the differential between the outdoor and indoor temperatures. The outside thermostat sets the sub-master which, in turn, controls the inside temperature. The instruments are operated by compressed air.

Hot air is collected from the paper machines through hoods. Stacks, extending from the hoods over the machines, can be raised or lowered by a telescoping operation.

The Minnesota and Ontario Paper Company reports that even with outside temperatures of -30 F, the economizers heat the air to 69 F, a rise of 99 degrees, without calling upon heat from the central steam system. This has resulted in substantial fuel savings.

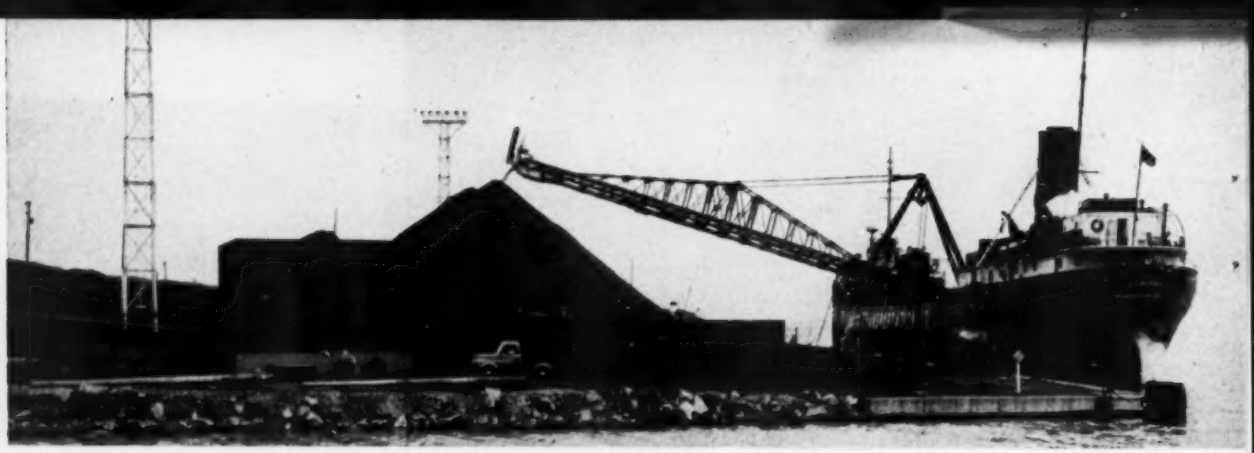


The hood gathers vapors from machines and carries them to the economizer.



Minnesota and Ontario Paper Co.

This section of the economizer shows some of the motors that are installed to drive the intake and exhaust fans.



Coal is delivered by ships during eight months of the year. Stock piles provide sufficient coal for winter operations.

Controlling Coal Dust at Detroit Edison

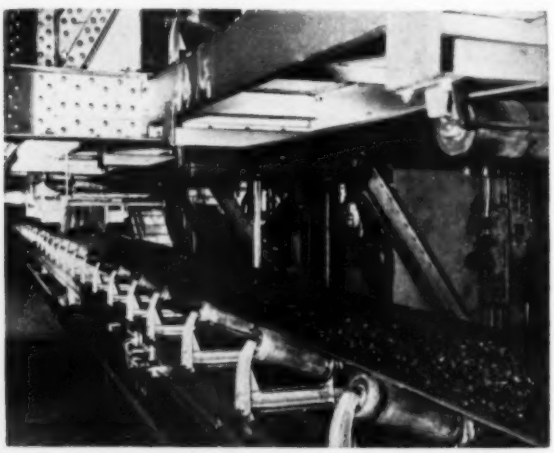
W. O. VEDDER, Manager
Dust Control Department
Pangborn Corporation

TRANSPORTING 4½-million tons of coal annually, and controlling the dust it kicks up, would be a major problem for any industrial plant or even a coal mine. At Detroit Edison Company's Connors Creek plant, handling an average of 11,000 tons a day to keep more than one million customers supplied is not only a big job, but a dirty one. Recently, this company invested $6,000,000 in material handling equipment to solve their problem. Furthermore, they recognized the costs involved with uncontrolled dust and specified that Link-Belt Co., in charge of engineering and supplying the system, incorporate dust control in the original design.

Unlike many utilities, Detroit Edison competes with two publicly owned electric producers in addition to other sources of energy; such as gas, oil, coal, and steam. Consequently, in accomplishing their objective—producing electricity at low cost so that consumer prices can be competitive—they are as eager to cut costs and increase efficiency as any well managed industry. The company has found it is good business to utilize modern methods and equipment, such as the new coal handling system now in service at the Connors Creek plant.

This new system provides an efficient, dependable, and economical method for transporting huge quantities of coal from dockside to boiler. Continuous belt conveyors, stacker conveyors, and hoppers integrated with unloading, breaker, and transfer houses, move as high as 800 tons of coal an hour. The dust control equipment incorporated into the design of the system diminishes fire and explosion hazards, keeps costly dust damage to expensive machinery at a minimum, materially reduces housekeeping costs, recovers appreciable quantities of coal dust, and contributes to better community and employee relations.

At Detroit Edison's Connors Creek plant, annual coal consumption averages approximately 4½-million tons.



The new conveying system moves the coal from dockside to the boilers at a rate of 400 to 800 tons per hour.

Two 20,000 cfm collectors with exhaust fans are used to remove dust from key locations in the surge bins.

Salvaged coal particles are returned automatically to the conveyor system from the breaker house collector.

Dust explosions can result in expensive property damage, and even more serious, injuries to employees and the public. Primary explosions often originate from ignition of a small amount of dust in suspension. The pressure and vibration thus created may be sufficient to dislodge large accumulations of dust on horizontal ledges or surfaces of the building and equipment, thereby causing a secondary explosion of great force.

Fortunately, dust explosions are no longer a common occurrence. Dust control equipment prevents highly flammable fine particle accumulations at points where ignition could occur inside the equipment. It also prevents escape of dust which might settle on horizontal surfaces and become a potential source of disaster at some distance from the dusty operation.

Another practical reason for controlling the dust from raw coal handling operations is the savings that are achieved by minimizing dust damage to expensive machinery. In addition, maintenance and housekeeping costs are reduced substantially, and appreciable quantities of dust which would otherwise be lost are recovered. The dust from 4½-million tons of coal would heat many private residences and in this instance represents a profitable annual salvage.

At Detroit Edison, coal normally is brought in by self-unloading steamers or barges, discharged to the dock, and bulldozed to underground feeders. During the winter season (December 15 to April 15) when coal cannot be brought in by ship, some coal arrives by rail. However, the majority of it is routed into the conveyor system from outdoor stock piles which are built up during the summer months.

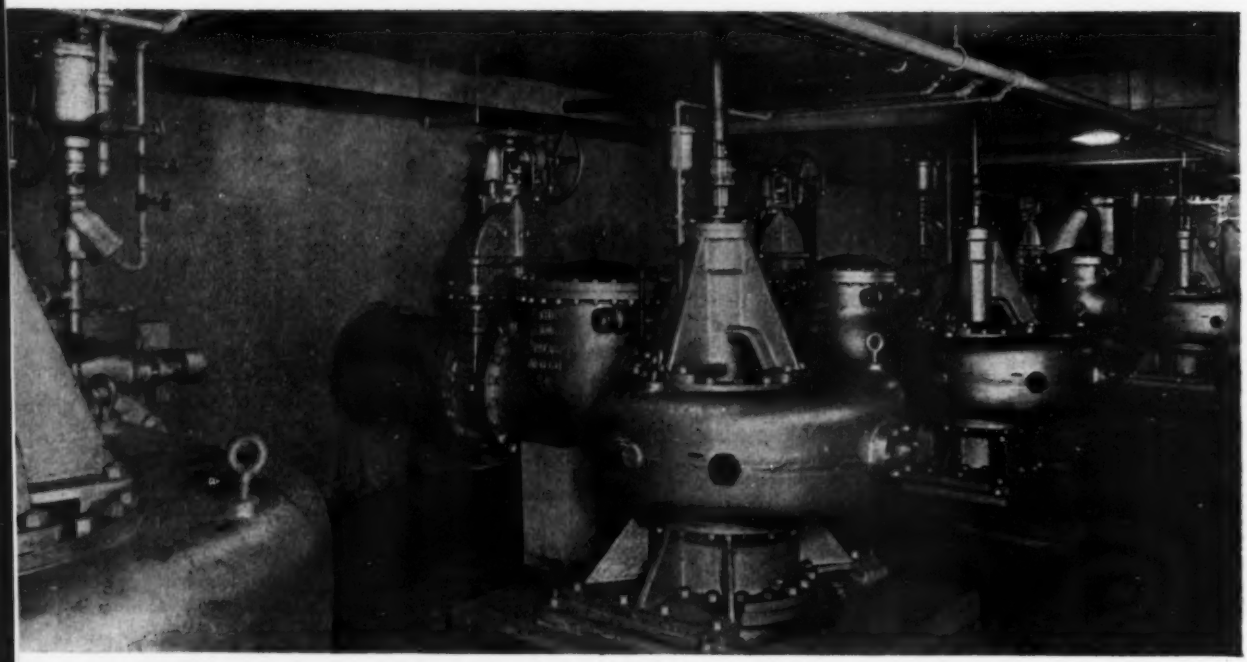
Single belt, yard conveyors transport the coal from the underground feeders to the unloading house, from which it is routed onto one of two interchangeable belts. These two conveyor belts move the coal to the breaker house, where it is broken into smaller pieces, approximately one inch in size. This breaker house operation is an important dust source. A large, cloth screen collector with 16 hoods exhausting 40,000 cfm of dust laden air is installed at this point. Collected dust drops into hoppers and is fed directly back into the coal handling system.

The coal travels from the breaker house to the transfer house. Here specially designed scales weigh 400 to 800 tons of coal hourly as it moves past on the conveyors. Dust developing at this location is removed by a collector with four hoods which exhausts 10,700 cfm.

An elevating conveyor equipped with magnetic pulleys, to remove any tramp iron, carries the coal from the transfer house to surge bins. These bins provide temporary storage and serve as a distribution center. The plant has two boiler systems, high pressure and low pressure, and each burns a different type of coal. Ohio strip coal, a low grade fuel, is routed from the surge bins into bunkers adjacent to the high pressure system, stored temporarily, and then pulverized before being blown into the boilers. The low pressure, stoker fired system uses a better grade of southern coal which is fired in the one inch size just as it comes from the breaker house.

Two 20,000-cfm collectors are installed at the surge bins. This system includes 16 dust hoods, serving the tail pulley of the conveyor for the low pressure boilers and all of the high pressure system conveyor. They also provide dust control for the head pulley and the rest of the low pressure section conveyor as well as the distribution conveyor feeders. Dust collectors are the standard cloth screen type, but hoods and piping were specially designed for this job.

Good community and employee relations are contributions of effective dust control. States and municipalities are paying more attention to the air pollution problem. Allergies, such as hayfever, asthma, eczema, and dermatitis, which are sometimes contacted from air-borne impurities, are less common when nuisance dusts are controlled.



Vertical double suction volute pumps, as those shown above, are the preferred type for the larger water supply services.

Centrifugal Pumps . . . Vertical Dry and Wet Pit Types

There are many applications where by virtue of location, hydraulic conditions or efficiency of operation, vertical dry or wet pit centrifugal pumps are better adapted to perform required services than horizontal types.

IGOR J. KARASSIK & ROY CARTER
Worthington Corporation

ALTHOUGH A GENERAL DISCUSSION of centrifugal pumps is usually based on horizontal shaft types, since they are the ones most widely used, the vertical shaft pumps also have their fields of application. The vertical shaft type of centrifugal pump falls into one of two classifications: dry or wet pit; the former is operated in air while the latter is submerged or partially submerged in the liquid supply.

Vertical dry pit pumps with external bearings are used as: sewage pumps, intermediate and large drainage and irrigation pumps (for medium and high head), large condenser circulating pumps, water, and marine pumps. Sometimes, the vertical design is preferable because of the smaller floor space requirements—as for marine pumps. Again, it may be desirable to have the pump at a low elevation because of suction conditions, while at the same time the motor or driver is set at a higher elevation. In very large capacity pumps, the vertical type is generally used because, all things equal, it is more economical.

Many vertical dry pit pumps are basically horizontal designs with minor modifications, generally in the bearings, to adapt them for vertical shaft drive. On the other hand, where a pump was originally designed for vertical usage, say as a sewage pump, horizontal types may have been adapted from vertical models already existing.

Most of the small and medium size sewage pumps have elbow suction nozzles. This is because the suction supply is often taken from a wet well adjacent to the pit in which the pump is installed. The larger sewage pumps as well as the larger drainage, irrigation, condenser circulating and water supply pumps are of the vertical bottom suction type. For some purposes, the vertical double

suction type pump is more suitable.

When a vertical pump is designed for condensate service or other applications for which the eye of the impeller must be vented to prevent vapor binding, a pump with a bottom single-inlet impeller is not feasible because it does not permit effective venting. This is also true for the lower eye in a vertical pump employing a double suction impeller. The most desirable design characteristic for these vertical pumps is a top single-inlet impeller.

The driver of a vertical dry pit pump can be located immediately above the pump and often directly supports the pump itself. The pump shaft can then be rigidly coupled with the driver shaft and supported on a common thrust bearing generally found in the driver. The shafts of the pump and driver may also be connected with a flexible coupling with each shaft having its own thrust bearing for support.

Intermediate shafting is used to connect the pump and the driver when the driver is mounted some distance above the pump. The design of this shafting depends on the power to be transmitted, the speed, the total length, and the bearing design used in the pump and motor.

Universal-Joint Shafting

The shafting most widely used for small or medium sized centrifugal pumps is the universal-joint type with hollow tubing. The lower section has a universal joint at both ends while the upper sections, if more than one section is used, has a guide bearing supporting the lower end and a universal joint at the upper end. This type of shafting compensates for angular misalignment and, as the lower section also incorporates a splined joint, also compensates for any minor discrepancy in length. When speed permits their use, shaft sections up to 120″ in length can be installed. Longer sections are too easily sprung in handling to make their use advisable.

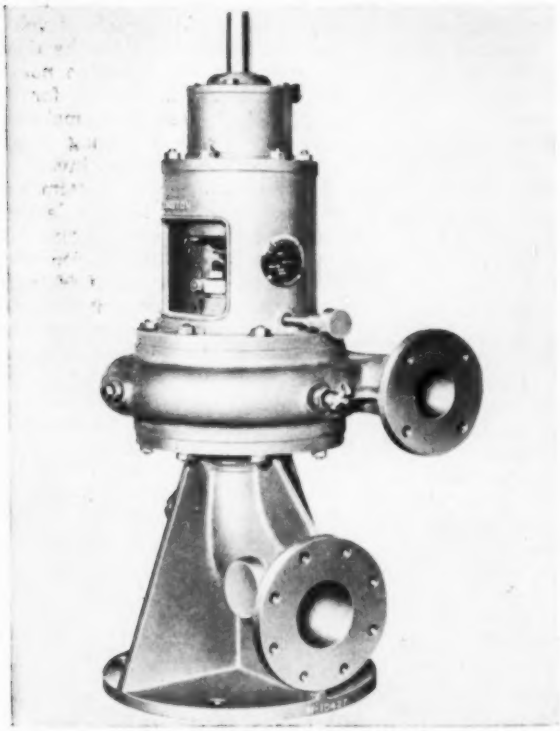
The universal-joint type shafting does not transmit thrust so that if used, the pump and driver must each have a thrust bearing. When installing the driver, sufficient room must be permitted to allow access to the flange connection and upper universal-joint for bolting up the flanges and re-lubrication.

For those units which require more torque than can be transmitted by the available sizes of universal-joint type shafting, solid shafting is practical, either in conjunction with solid couplings or with flexible type couplings. Solid shafting has the disadvantage that all the bearings of the unit must be in accurate alignment if the pump is to operate smoothly. Where more than three bearings are involved, this becomes very difficult to resolve.

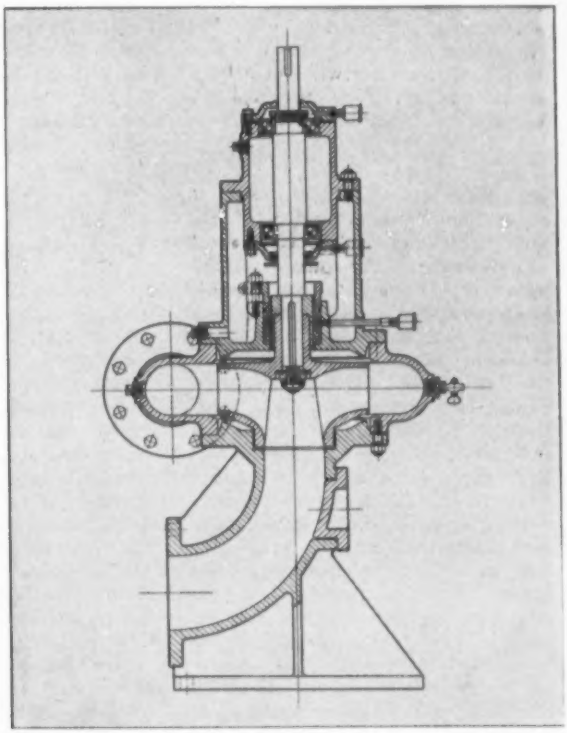
Solid vertical shafting is made up of shaft sections with flexible couplings (including pump and driver). Each shaft section has two or three bearings to support it. At the ends of the section are piloted or guided flexible couplings. The whole unit acts in effect like a universal-joint. Each section with bearings has to have one acting as a thrust bearing to carry the weight of the shaft section and thrust load.

Shafting Design Considerations

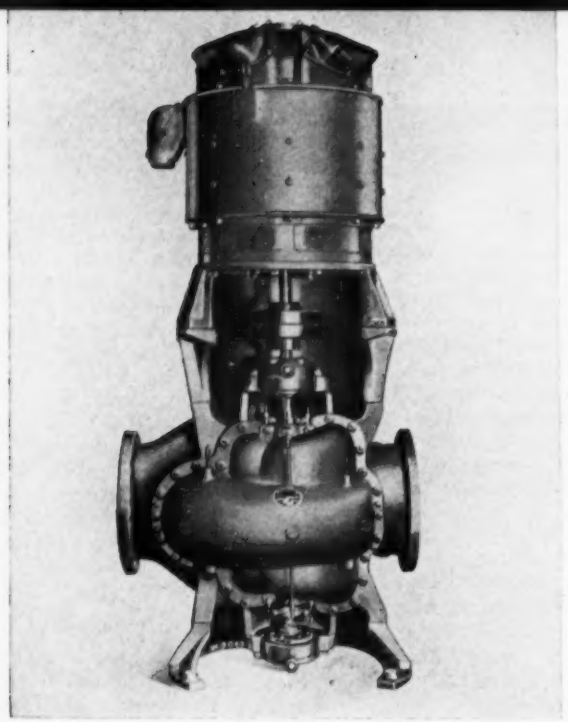
The size of the shafting is usually determined by the torque to be transmitted. If a certain span between bearings is desirable because of existing supports (floors or beams), a shaft size larger than would be required by the torque load alone may be necessary. This is to insure that the operating speed will remain sufficiently below the critical speed. The critical speed of



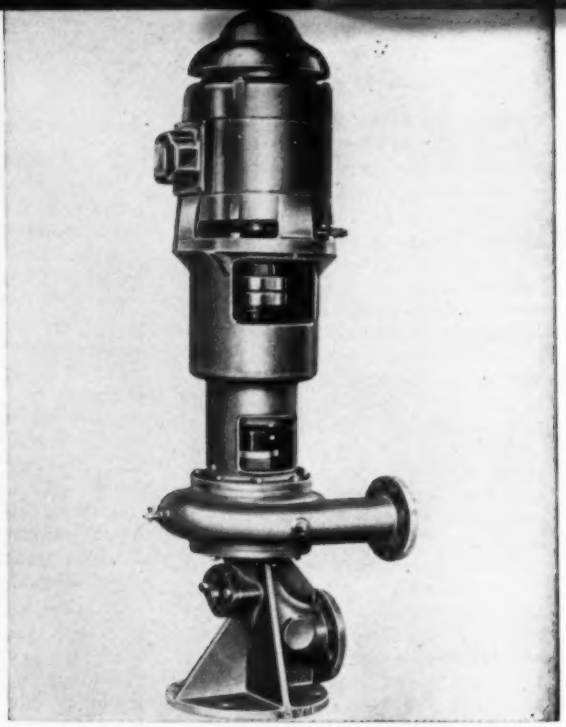
Typical small capacity vertical sewage pump for drive through intermediate shafting.



A section of the same vertical sewage pump showing the location of the thrust bearings.



Vertical double suction volute pump with a cutaway view of the coupling to the direct mounted motor.



This small capacity vertical sewage pump is coupled through intermediate shafting with the mounted motor.

a vertical solid shaft is a direct function of the diameter and an inverse function of the square of the span between the bearings.

It is important that the supports for the guide bearings of vertical shafting be sufficiently rigid. The radial load is assumed to be the same as though the unit were in a horizontal position. With this loading, the deflection should not exceed: $d = \frac{(187.7)^2}{(n_c)}$; where d equals the deflection in inches and n_c equals the critical speed of the shafting. The critical speed is about 125 percent of the pump rotative speed, or a value above the possible runaway speed in case there is back flow through the pump.

Where beams or channels are used to support the bearings, their design is dependent on their spans the radial force and the permissible deflection. Small pump installations with short spans generally require a single channel to which vertical surface mounting bearings are most easily attached. Larger units with long spans often require fairly wide spaced channels or beams with strengthening lattice work. For the latter type of bearing support, a horizontally mounted guide bearing resting directly on the beams or on a bridging plate has been found to be most suitable. It can therefore be said that smaller units favor vertically mounted guide bearings and larger units favor the horizontally mounted type guide bearings.

The bearings for vertical dry pit pumps and for intermediate guide bearings are of the anti-friction type, grease lubricated to simplify the problem of retaining the lubricant in a housing having a shaft projecting vertically through it. In larger units, where anti-friction bearings are not available or desirable, self-oiling babbitt bearings or forced-feed-oiled babbitt bearings with a separate oiling system are recommended for use.

Structural Characteristics

Structurally, vertical dry pit centrifugal pumps are similar to horizontal shaft pumps. Many of the very large vertical, single-stage, single-suction (usually bottom) volute pumps, which are the preferred type for storm water pumpage, drainage, irrigation, sewage, and water supply projects, have no comparable counterpart in the horizontal shaft type. The casings of such pumps are basically of the U section—which is structurally weak. Heavy ribbing is necessary to make the casing sufficiently rigid.

In water turbine practice, a set of vanes (called a speed-ring) between the casing and runner serve to act as struts. While such a speed-ring does not adversely affect the operation of a water turbine, in a pump it would function fundamentally as a diffuser with the inherent hydraulic limitations of that construction. Some of the large pumps of this type with high head have been made in the twin-volute design. The wall separating the one volute and the passageway from the second volute and its passageway, from the tip of the volute to the discharge nozzle, acts as a strengthening rib for the casing. The twin-volute makes it easier to design a casing strong enough for the pressures involved.

Vertical pumps with bottom single-inlet impellers have a leakage joint between the wearing ring hub of the impeller and the suction head. When pumps of this type are handling gritty water, the grit separates out and concentrates at or near this joint during the periods of shutdown. When the pump is started again, this grit is washed through the leakage joint with resulting wear. For large pumps it is practical to extend the stationary ring above the suction head forming a pocket in which the grit will be deposited and from which it can be periodically flushed and cleaned.

Vertical Wet Pit Pumps

There are a number of vertical pumps intended for submerged operation.

These wet pit centrifugal pumps can be classified as:

(a) Vertical turbine pumps;

(b) Vertical wet pit propeller or

modified propeller pumps;
(c) Wet pit sewage pumps;
(d) Wet pit volute pumps;
(e) Sump pumps.

Choice of the type of pump for any given service will be determined by the operating requirements.

Vertical Turbine Pumps

Vertical turbine pumps were originally developed for pumping water from wells. They have been called deep well, turbine well and borehole pumps. As their application to other fields has increased, the name vertical turbine pumps has been generally adopted by the manufacturers.

The largest field of application is in pumping water from wells for irrigation and other agricultural purposes, for municipal water supply and for industrial uses for processing, circulating, refrigerating, and air-conditioning water supplies. In addition, they have also been used for brine pumping, mine de-watering, oil field re-pressuring, and similar applications as these.

These pumps have been made for capacities ranging from 25 to over 25,000 gpm, with heads up to 1000 feet. When pumping from bored wells, the capacity of the pump is limited by the physical size of the well in which the pump will be installed and by the rate at which water can be drawn from the well (without lowering the water level in the well to the point where there is insufficient submergence).

In a vertical turbine pump it is desirable to make provision for readily raising or lowering the shaft so that the position of the impeller in the bowl can be properly adjusted as necessary.

This type of pump requires an adequate thrust bearing to support the vertical shafting, the impeller, and the hydraulic thrust developed when the pump is in service. Since the driver must also have a thrust bearing to support its vertical shaft, it is customary to incorporate a large enough thrust bearing in the driver to carry the pump parts as well.

The hollow shaft type of motor or gear motor is most generally used for vertical turbine pump drives. Besides the thrust bearing in the hollow shaft motor or gear drive, these pumps are often made with their own thrust bearings for belt drive and for drive through a flexible coupling, by a solid shaft motor, gear, or turbine connection. Dual driven pumps usually have a combination of an angle gear with a vertical motor mounted on top of the gear as a driver.

The bowl assembly or section consists of the following parts: suction case (also called suction head or inlet valve), impeller (or impellers), discharge bowl, intermediate bowl (or bowls if more than one stage is involved), discharge case, bearings, shaft, and such miscellaneous pieces as keys, and impeller locking devices commonly used.

The column pipe assembly consists of the column pipe itself, the shafting above the bowl assembly, shaft bearings, and cover pipe or bearing retainers. The pump is suspended from the driving head. This head has a discharge elbow (if above ground discharge), a motor or driver support, and either a stuffing box (for an open shaft), or an assembly for maintaining tension on the cover pipe. The latter must also provide for the introduction of lubricant to the cover pipe. In case of below ground discharge, the discharge is taken from a tee in the column pipe and the driving head functions solely as a stand for the driver and the support for the column pipe.

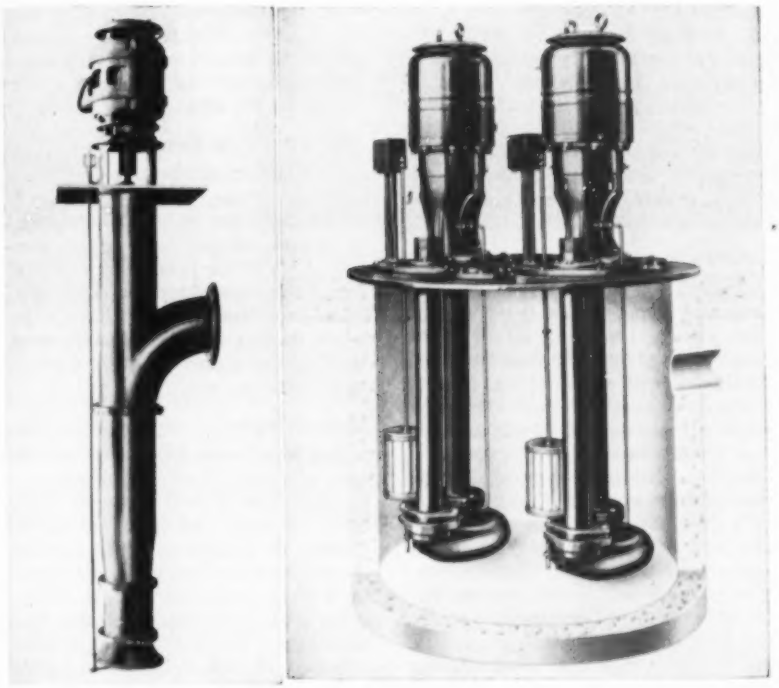
In a vertical turbine pump the liquid is guided into the impeller by the suction case or head. This may be in the form of a bell mouth or a tapered section for attachment of a conical type strainer or a suction pipe arrangement.

Both semi-open and closed types of impellers are commonly used. For proper clearances in the various stages, the semi-open type requires more care in spacing on the impeller shaft and requires more accurate adjustment of the shaft position. The semi-open type impeller seems to be preferred for installations in which there is considerable sand in the water to be pumped.

Vertical Propeller Pumps

Originally the term, vertical propeller pump, was applied to vertical wet pit diffuser or turbine type pumps using a propeller or axial flow type impellers, installed in an open sump and having a relatively short setting. For operating heads in excess of those feasible with a single stage axial flow impeller, two or more stages might be used. A single stage lower specific speed type of pump with a mixed flow impeller may also be acceptable. If the operating head is high enough, a pump with mixed flow impellers in two or more stages is another alternative. For lack of a more suitable name, these higher head design pumps have been considered as part of the propeller pump classifications mentioned.

Vertical turbine pumps and vertical modified propeller pumps are basically of the same type and show



The vertical propeller pump classification includes the vertical propeller sump pump at the left as well as the duplex turbine sump pump at the right.

similar hydraulic characteristics when operated at the same specific speed. However, there is a difference in that a basic turbine pump design can have a large number of stages, while the modified propeller pump, because of its mechanical design, is primarily intended for a maximum of two or three stages.

Most of the wet pit drainage, low head irrigation, and storm water installations employ pumps of the conventional propeller or modified propeller type. There has been some application of this type of pump for condenser circulating service.

Where water with highly corrosive properties is being pumped, a fabricated steel column pipe and elbow are not practical. Cast iron, bronze, or even a more corrosive resisting cast metal must be used. This metal may add considerably to the weight of the pump, especially if the pump is of a large capacity. To avoid the necessity of lifting this large mass when the rotating parts need maintenance, some designs have provisions so the impeller, diffuser, and shaft assembly can be removed from the top without disturbing the column pipe assembly and installation.

Like vertical turbine pumps, the propeller and modified propeller pumps have been made with both open and enclosed line shafting. Except for condenser circulating service, the enclosed-type, using oil as a lubricant (except for grease lubricated tail bearing below the impeller), seems to be favored. For pumps handling condenser circulating water, some designs use an enclosed type shafting, but with water as a lubricant, thus eliminating any possibility of oil getting into the circulating water and coating the condenser tubes with oil.

Wet Pit Sewage Pumps

Except for some large, vertical, propeller type pumps handling dilute sewage (basically storm water contaminated by domestic sewage), vertical wet pit sewage pumps are of the bottom suction volute type with impellers capable of handling solids and stringy materials with minimum clogging. This type of pump is suspended from a raised floor by means of a drop pipe and uses covered or enclosed type shafting similar to the vertical turbine pump installations. Except for a bell mouth suction inlet and changes in bearing and stuffing box construction, these pumps are hydraulically and mechanically similar to their dry pit counterparts.

Three basic constructions have been used for this type of pump. The first, built with impellers without back rings, employs a water or grease lubricated bearing with a seal immediately above the impeller at its lower end. The upper end of the bearing is vented to the suction pit to prevent any appreciable hydraulic pressure on the seal at the lower end of the shaft cover pipe. The seal at the lower end of the impeller bearing must be effective, especially with high pump heads, if it is to prevent leakage of water through the bearing. If there is grit in the water it will cut the seal.

A second construction is similar but employs pump-out vanes or wearing ring joints on the back side of the impeller (the latter necessitating balance holes through the impeller hub), so the bearing is subjected only to suction pressure.

A third type of construction, used primarily with impellers having no back rings or pump-out vanes, retains a stuffing box in some form, with bearings above the stuffing box and separated from it.

While shaft seals and packing which are used to seal the lower end of the cover pipe or bottom bearing are intended to exclude water as much as possible, some leakage of liquid with higher suction water levels is to be expected even when the seal is new. Some of the shaft bearings may have to operate in water or in a mixture of oil and water, so the bearing may wear faster than one positively lubricated with oil or grease. Wet pit sewage pumps should be limited to services requiring operation for a very limited period of the day.

Wet Pit Volute Pumps

In addition to the more common wet pit sewage pumps discussed, there have been various installations of volute pumps; some single suction with either bottom or top suction; and others double suction, supported on the pit floor. Except for a few floating dry dock installations, this type of pump has little modern application or use.

Sump Pumps

The term sump pump conveys the idea of a vertical wet pit pump suspended from a floor plate or sump cover, or supported by a foot on the bottom of a well—usually motor-driven, and automatically controlled by a float switch, to remove drains collected in the sump. The term does not indicate any specific type of construction, as both diffuser and volute type, single or multi-stage, with open and closed impellers of a wide range in specific speed type, have been employed for this service.

For the very small capacity field, where fractional hp motors can be used, "cellar drainers" are available. These are small, usually single-stage volute pumps, with single suction impellers, either bottom or top suction, supported by a foot on the casing with motor supported some distance above by a form of a column enclosing the shaft. Such "cellar drainers" are made as complete units, with float, float switch, motor and strainers, completely assembled as a unit for household use.

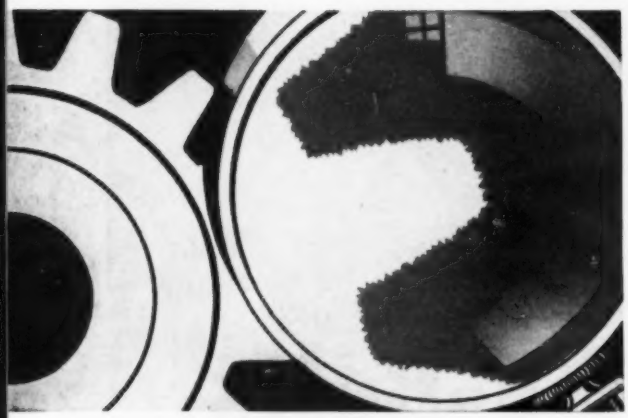
Larger capacity sump pumps may be of the vertical propelled or turbine pump type (single or multi-stage), or of the vertical wet pit sewage or volute type. Where solids or other waste materials may be washed into the sump, the vertical wet pit sewage type pump with a non-clogging type of impeller is preferred and recommended.

The larger capacity sump pumps are of standard designs. Generally, they are obtainable for any practical length pipe column, with various size sump covers. Often duplex units, that is, two pumps on a common sump cover, possibly with a manhole for access to the sump, are used. Such duplex units could have the pumps operate in a fixed order; or a mechanical or electrical alternator can be used to equalize the operation of the two pumps.

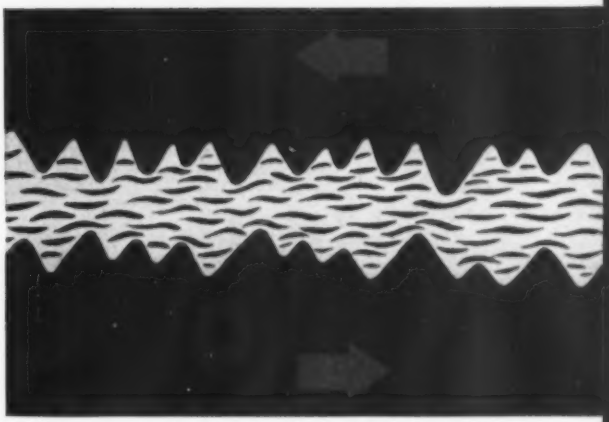
Application of Vertical Wet Pit Pumps

The advantages of the vertical wet pit type of pump are mainly hydraulic. The disadvantages are primarily mechanical. With the impeller (or first-stage impeller in case of multi-stage pumps) submerged, there is no priming problem, and pumping can be automatically controlled with no danger of the unit running dry. Also being submerged, the net positive suction head is greater, often permitting a higher rotative speed for the same service conditions. The only mechanical advantage is that the motor or driver can be located any desired distance above the floor level. The mechanical disadvantages include the possibility of the pump freezing while standing idle in cold weather. There may be also danger of damage by floating objects if the pump is in an open ditch or body of water. There is the inconvenience of pulling and dismantling for inspection and repairs, no matter how minor. And finally, there is the relatively short life of the pump bearings unless the water conditions and bearing design are ideal.

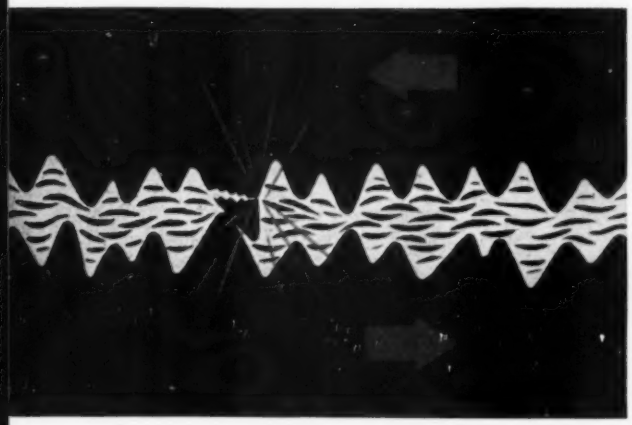
HOW SUNEP PREVENTS GEAR WEAR



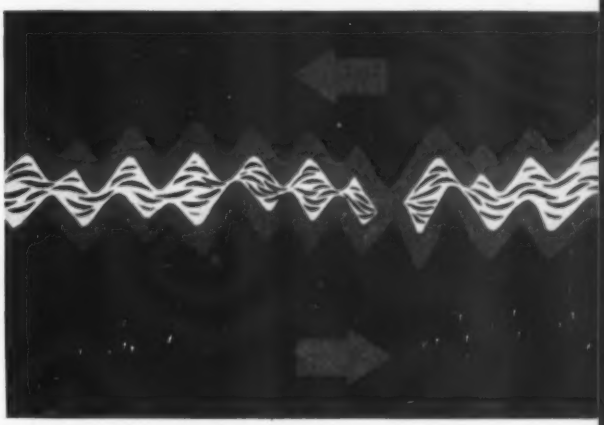
The surface of a gear may seem smooth, but when greatly magnified it looks something like this. The lubricant must keep these jagged edges apart.



With ordinary oil, a thick film is needed to keep these metal surfaces apart. The thickness of the film depends on the viscosity of the oil and other factors.



It is difficult to maintain a thick oil-film in everyday practice. The oil film thins out and semiboundary lubrication results. With ordinary oil, metal to metal contact occurs and gears wear.



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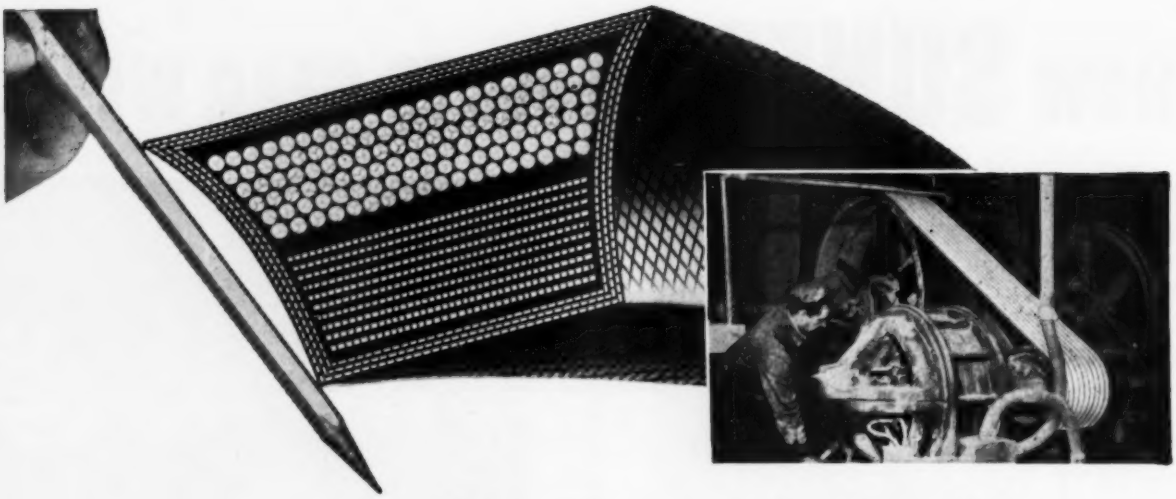

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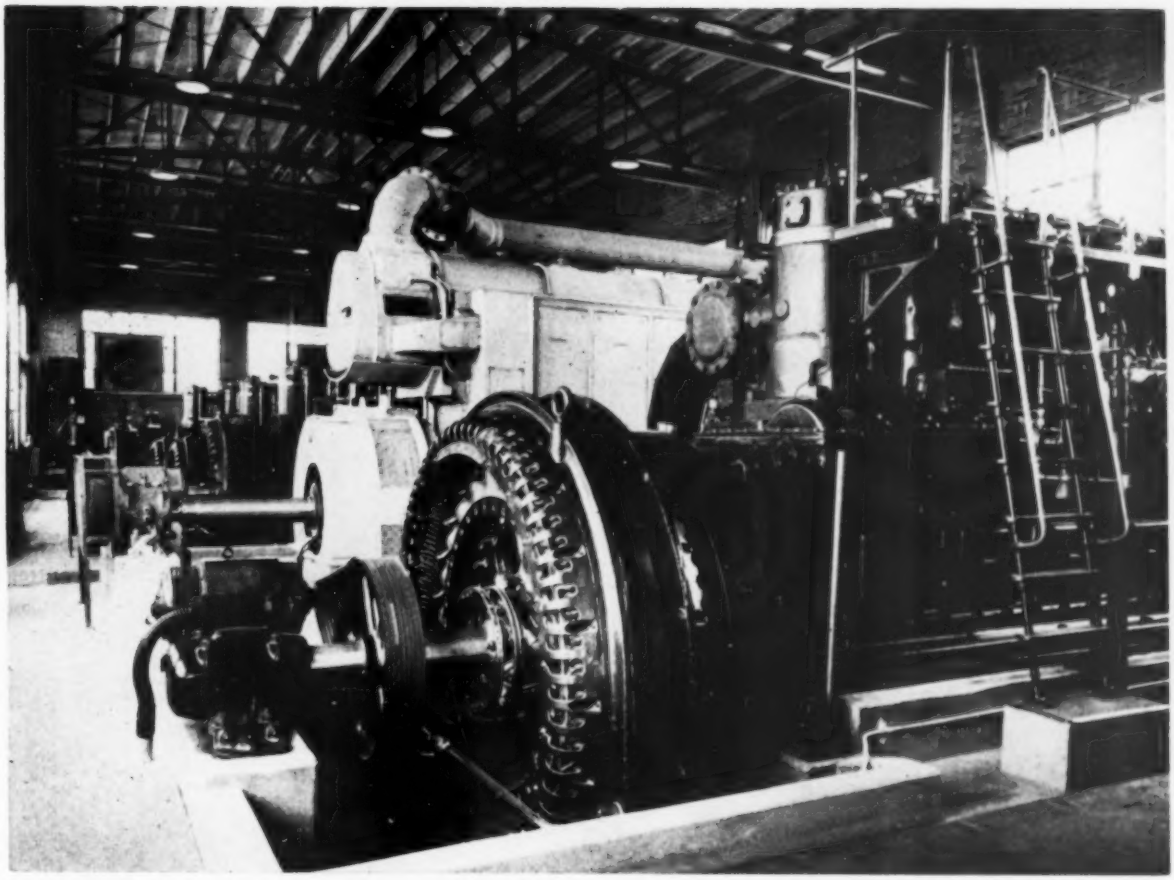


The Teague plant houses six engines ranging from 180 hp to 960 hp. The new dual-fuel diesel unit is second from right.

New Diesel Halves Fuel Costs

ROBERT D. SLONNEGER,
Asst. Professor of Mechanical Engineering, University of Texas

AN OPPOSED-PISTON, dual-fuel diesel engine, utilizing low-cost natural gas as the principal fuel, has more than cut in half the costs of fuel for power generation in the Teague, Texas Municipal Power Plant. The flexibility and economy of this 960 hp unit enables the plant to carry loads efficiently from 150 kw to 675 kw using the cheaper fuel.

Higher fuel costs and the fact that the existing plant was rapidly becoming crowded with small engines, caused a major change in the plant operation. Taking into consideration that natural gas is by far the cheapest fuel available in the area, it was decided to install a dual-fuel engine. In August, 1952, a 960 hp, 8¼x10 in., 6 cylinder, Fairbanks-Morse, opposed-piston, dual-fuel engine, was put into service. Table 1 shows the savings realized between June, 1952 and May, 1953.

During the period following the

The municipal power plant is modernized outside as well as inside.

This 960 hp, 6 cylinder, Fairbanks-Morse dual-fuel opposed piston engine drives a 675 kw generator in the Teague plant.

The pump seal of this centrifugal pump circulating raw water remains unbroken after 24 years of virtually continuous operation.

installation of the opposed-piston engine, it was for the most part the only engine on the line. Therefore, practically speaking, the tabulated figures apply to this engine alone. Frequent inspections of the cylinders revealed no ring sticking and an extremely small amount of carbon deposits indicating almost perfect combustion with attendant long life for piston rings and cylinder liners to date.

The unusually small quantities of carbon, even though the engine operates much of the time at part load conditions (often as low as 150 kw), are believed to be due to the air by-pass control provided on the discharge of the scavenging air blower. At low loads, the air delivered by the blower can be by-passed from the discharge to the suction, thus maintaining excellent combustion efficiency. As the engine load drops, the operators watch the exhaust py-

rometers and reduce the air flow to the engine until uniform temperatures are indicated from each cylinder. This operating technique assures balanced loading of all of the engine cylinders for efficiency.

A "Cycloil" type oil-bath, intake air filter and silencer are used on the suction of the gear driven, Roots-type, blower for scavenging air. Air is discharged from the blower at about 2½ psig passing through the manually operated control valve before reaching the supply manifold to the cylinder intakes.

Natural gas is supplied to the plant at 26 psig where it is metered and reduced to 25 psig. In the event of a failure in the gas supply, the governor switches the engine to operate on fuel oil.

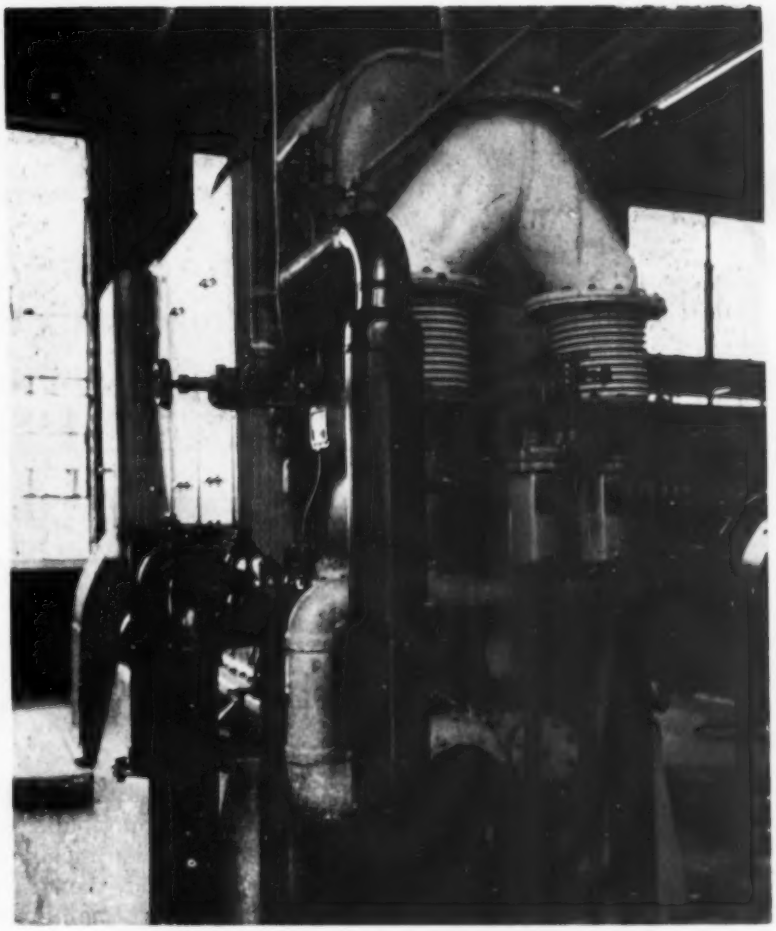
The engine is started with 250 psig compressed air stored in six reservoir tanks. Two motor driven and one gasoline engine driven compressors maintain the supply.

A heavy-duty, detergent type oil was selected for lubricating the engine. The wet sump has a capacity of 240 gallons. At the present time, the operators find it necessary to replace only 4½ gallons each day. A cartridge type filter of the by-pass type and a strainer are used in the system. The engine-driven pump and the before-operation pump are both gear type, the latter being driven by an electric motor. The before-operation pump is used only to bring the lube oil pressure up before starting. A change of oil filter elements was made after 6000 hours of operation, and it is planned to change elements at least once each year, depending on the condition of the oil. This long filter life is another indication of clean operation and good combustion.

A study was made of the lubricating oil costs for the plant before and after the installation of the new unit. On the basis of 50 to 60 cents per gallon, June and July, 1952, showed lube oil costs of 0.72 and 0.75 mills per kwh. This was prior to operation of the new engine. August through November, break-in period for the new engine, averaged about 0.60 mills per kwh. The final settling of the piston rings reduced the cost to 0.37 and 0.36 mills per kwh in December, 1952, and January, 1953, respectively. Expressing the figures for the last two months in a different manner: December shows 4578 horsepower hours per gallon of oil and January shows 4994 horsepower hours per gallon of oil.

Cooling water is circulated through the oil cooler and then through the jacket water exchanger by a centrifugal pump. Shell and tube heat exchangers are used in conjunction with an outside cooling tower. Jacket water leaves the engine at 150 F. This temperature is thermostatically controlled with the rise in the engine temperature limited to 5 to 10 degrees F increase.

The engine operates at 720 rpm and is direct-connected to a 675 kw Fairbanks-Morse generator with a belt-driven exciter. An engine control and alarm panel is located near the blower end of the engine.



A rear view of engine showing the exhaust header, fuel filter and governor.

TABLE 1—OPERATING DATA JUNE 1952 TO MAY 1953

Month	Total kwh	Lube oil gallons	Fuel oil gallons	Gas M cu ft	Fuel cost dollars	Fuel cost mills/kwh
June	275,300	402	24640	—	2233.80	8.1
July	312,100	473	26820	—	2449.15	7.8
Aug.*	348,500	346	4782	3998	1280.77	3.6
Sept	285,600	272	3558	3506	1052.75	3.6
Oct	237,500	263	6525	2507	1122.40	4.7
Nov	227,900	245	5970	2389	1045.65	4.5
Dec	249,600	156	3525	3253	937.42	3.7
Jan	240,200	143	3520	3213	931.21	3.8
Feb	214,400	134	3065	2969	833.51	3.9
Mar	241,200	130	3360	3331	918.87	3.8**
Apr	200,600	150	4910	3011	902.70	4.5
May	246,000	135	3455	3443	959.40	3.9

*New engine started in August 1952.

**New Fairbanks-Morse engine only unit in service for this entire month.

any way you look at it...

Superwashed

COALS ARE BEST!

From any angle, Bell & Zoller's *Superwashed* coals are best for keeping boiler efficiency up . . . steam costs down. Scientifically cleaned and correctly processed, the *right* coal for your burning equipment can be shipped via rail or economical rail-water routes from Kentucky, West Virginia, Indiana or Illinois.

BELL & ZOLLER COAL COMPANY

Bell Building • Chicago 1, Illinois

Zeigler • Oriole • Moss Hill • Murdock • Buckhorn
Spring Hill • Vesta Red Ash

SIXTY-SEVEN YEARS OF SERVICE TO COAL USERS • ST. LOUIS • LOUISVILLE • OMAHA • MINNEAPOLIS • TERRE HAUTE

Circle 556 on Reply Card for more data

STOWE Stokers

they eliminate smoke and fly ash nuisance saving users the cost of installing and operating special control equipment

Assure Clean Stacks

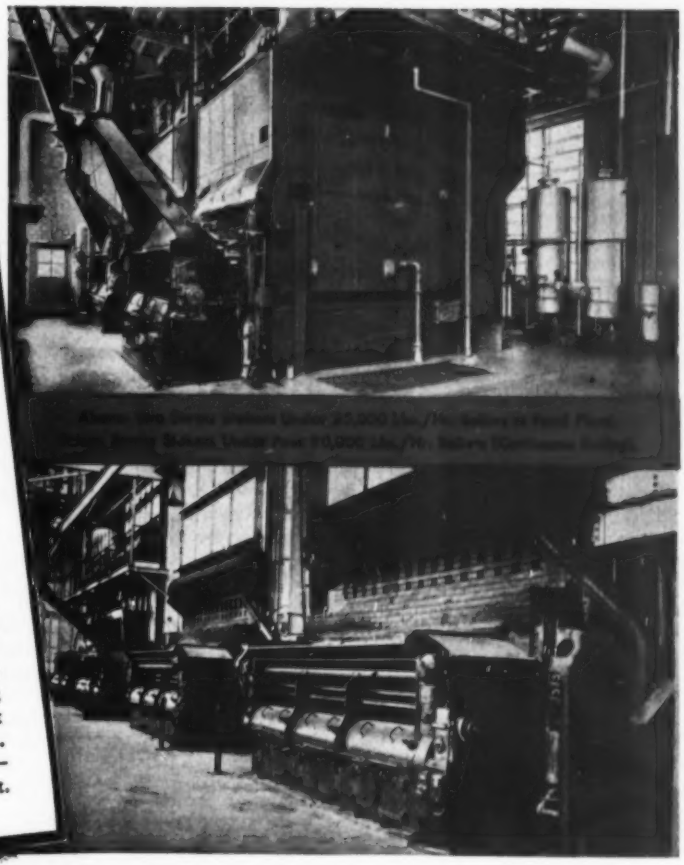
● Their even depth of fuel bed from side to side and all the way from front to rear enables Stowe Stokers to comply fully with the most rigid smoke and fly ash ordinances. They have **never** required the installation of any special control equipment.

LOW AIR PRESSURES

STOWE STOKERS don't have to blast air up through coal piled around raised tuyeres. Consequently they operate with wind-box pressures of 2/10" to 6/10" (1" maximum). The coal is burned **in the fuel bed** — not in suspension — eliminating fly ash problems and assuring clean stacks **at all ratings.**

PROVEN ADVANTAGES

CLEAN STACKS is only one of the advantages Stowe Stokers can give you. Extremely high rates of burning per square foot of grate area; rapid response to fluctuating loads; the ability to burn any grade of coal; are some of the others. Why not get full details? Write for Bul. No. 501. It tells **what** Stowe Stokers do — and **why** they are able to do it.



"More Power to You" with **STOWE Stokers**

Manufactured by THE JOHNSTON & JENNINGS CO. • 6917 Bessemer Avenue • Cleveland 27, Ohio
....Division of PETTIBONE MULLIKEN CORP...

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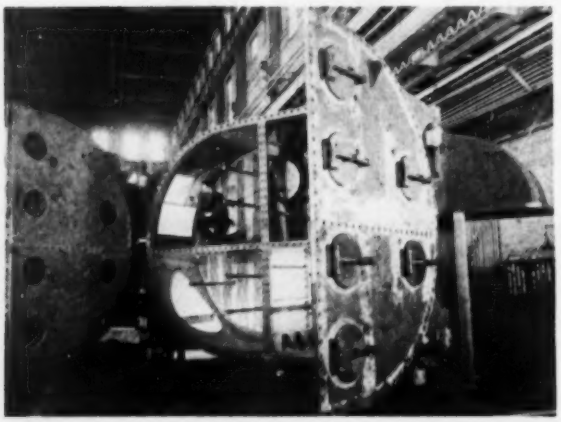
spot news

. . . what's happening in U. S. industrial plants



Space and Cost Savings Result From Water Box Design

Tailored to a midwestern power plant's requirements, this 12 x 16 ft, 3-in. front water box for a 50,000 sq ft, 2-pass, surface condenser, combines three unusual space and cost saving features.

Hinged water box covers, each fabricated from 2-in. steel plate and weighing 10,500 pounds, can be easily manipulated by one man, eliminating the need for crane facilities during retubing. A 30-in., motor-operated butterfly valve makes it possible to supply water to both halves of the condenser with one circulating water pump. This feature saves the user pumping charges during periods of low load and during seasons when extremely cold water is available. The 36-in. built-in elbows save space and make for one less connection and one less piece of equipment.

Fast Analysis of Flue Gases Possible With New Method

Because there is an increasing amount of sulfur in fuels being used today, its presence can have a serious corrosive effect on certain portions of a steam generating boiler. To provide a simpler and quicker means of analyzing flue gases, Mr. E. K. Diehl, associate fuel technologist, and Mr. R. E. Matty, senior chemist, at the Research Center of The Babcock & Wilcox Co., presented a paper at the American Chemical Society entitled "An Improved Method and Apparatus for the Determination of SO_2 and SO_3 in Boiler Flue Gas at any Operating Temperature."

Employing one standard solution of sulfuric acid which can be kept indefinitely without appreciable change in strength, the new method eliminates unstable standard solutions, which had been used previously, and requires only a small table, standard laboratory glassware, and a source of distilled water. Time required for the completion of such analyses has been reduced from one day to one hour, making it possible to collect samples during one test and obtain the results before a subsequent test on the same day.

The improved method is regarded as highly important because it provides the boiler designer with information that can serve as a guide in determining the minimum allowable airheater temperature for a given fuel and method of firing.

Flame Hardening Methods Utilize Natural Gas

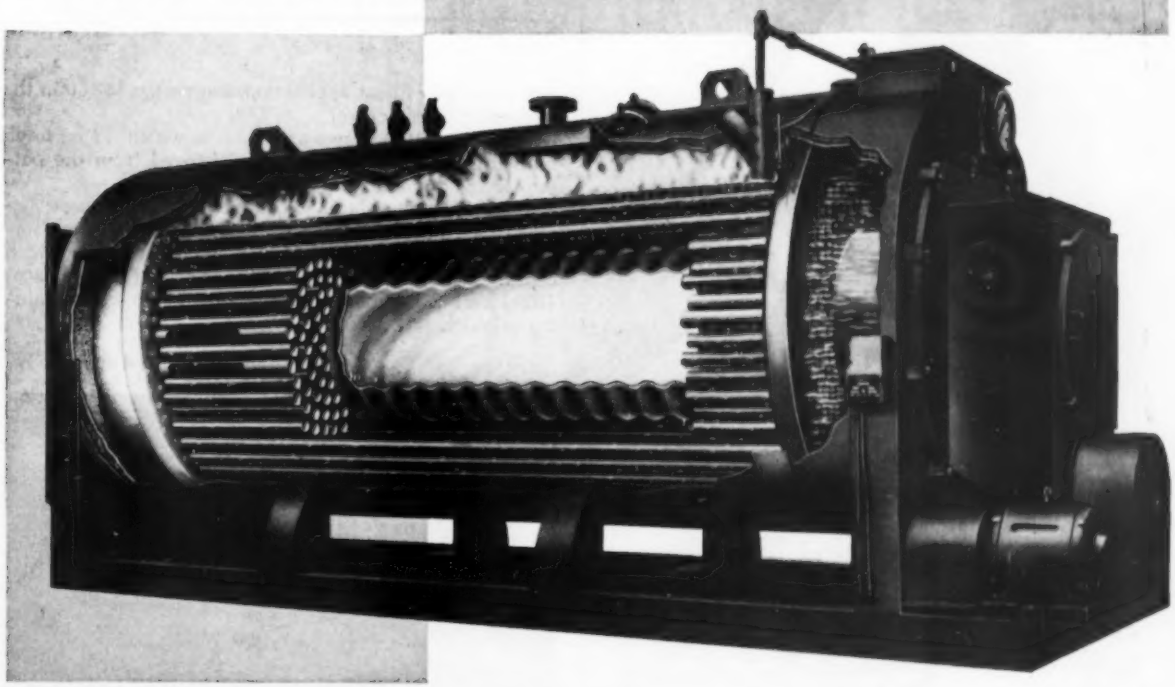
Natural gas is used extensively for specialized flame hardening methods and machines which have been developed by plant engineers at the Torrance, California plant of the National Supply Co. A comparatively small number of machines and torches have been adapted to flame harden many different parts. Most parts are finished machined and heat treated to the desired core properties before flame hardening because there is negligible distortion or carburization. When dimensions are critical, a small amount of grinding stock is left on the flame-hardened area.

Natural gas is mixed with oxygen to attain high enough temperatures to heat the surface of steel parts above the transformation temperature. The heated part is then quenched rapidly to room temperature by water or oil. Extremely shallow depths are hardened by a short intense heat and depths of ⅛ in. or more are hardened by heating more slowly.

Quality work is produced by close control of temperature, which is a critical factor. Although temperature is not measured directly, other factors such as type and design of the torch, pressures of natural gas and oxygen, space permitted between burner tip and part, and the

(Continued on page 104)

Do You Know About *Continental's* Two Pass Design?



...and do you know it takes one man less than 30 MINUTES to open a CONTINENTAL BOILER for cleaning or inspection...

WITH THE CONTINENTAL, you get a self-contained, automatic steam generator, built of best quality steel, and featuring advanced two pass design. The two pass design eliminates baffles that may break during operation and cause gases to short circuit and destroy efficiency.

WITH THE CONTINENTAL, 80% efficiency is guaranteed. Also, the use of forced draft and the elimination of baffles results in uniform distribution of heat through all tubes . . . insuring long life because all tubes do equal work.

WITH THE CONTINENTAL, you'll hold boiler down-time to a minimum because the clean-out and inspection doors at both ends are hinged and can be easily opened by one man in less than ½ hour.

WITH THE CONTINENTAL, fuel is fired directly into the firing tube which is completely surrounded by water. There is no dutch-oven and there is *no* refractory-lining in the water-backed furnace. This gives you maximum heat transfer, complete combustion, a high CO_2 and a low stack temperature. By eliminating refractory in the furnace, heat is transmitted to the boiler water without being stored and wasted in heating a refractory firebox . . . Steam with less than ½ of 1% moisture is assured in high pressure boilers, and less than 1% moisture in low pressure boilers.

WITH THE CONTINENTAL, you save on fuel (U. S. and foreign patents pending on exclusive firing method). The *oil burner* uses a pressure atomizing nozzle which is easy to service—has no cups or moving parts to wear out. The *gas burner*—rather than premixing—mixes fuel and air at the point of ignition, producing a uniform, highly radiant flame.

WITH THE CONTINENTAL, you get a boiler which, before shipment, is test fired and adjusted for maximum performance. No special stack or foundation required.

Continental Boilers, for high or low pressure, oil or gas fired—or combination thereof, range from 20 to 500 hp. Write for catalog 102.

CONTINENTAL is sold, installed and serviced by competent distributors throughout the U.S.

BE BOILER ENGINEERING AND SUPPLY COMPANY, INC.
7 Manavon Street • Phoenixville, Pa.
40 Years of Boiler Experience

Circle 558 on Reply Card for more data

Both these SPECIALISTS help you operate efficiently, reduce wasteful spending

No business would attempt to operate very long without the services of an accounting specialist.

And, no liquid handling program should be started without the guidance and recommendations of a WEINMAN Centrifugal Pump Specialist.

This man knows how to reduce your pumping costs by improving pumping efficiency and capacity. He can specify the right pumps for your needs with confidence, because that is his business — because his career and his success depend upon his ability to do so.

So, if you're considering the installation of new pumps, or the improvement of your present liquid handling system, call in a specialist . . . a WEINMAN Centrifugal Pump Specialist.

Representatives in principal cities.

WEINMAN

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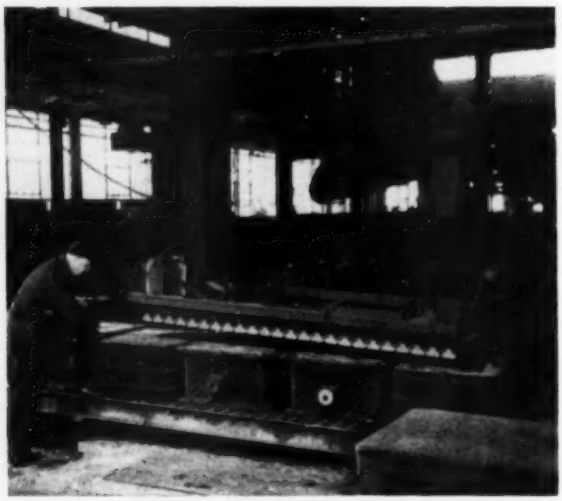
spot news

(Continued from page 102)

time interval of heat application, are varied to obtain the necessary close control.

The illustration shows a method in which a ring torch with a water spray attachment is moved from the bottom to the top of a rotating wash pipe.

Since hardness obtainable in steel is determined primarily by the carbon content of the steel, the most common types used are carbon and low alloy steels which contain 0.3 to 0.5 percent carbon. The hardest surfaces (Rockwell "C" or better) are obtained in steels containing as much as 1 percent carbon.



Mold Wash Drying Faster By Conveyor-Heater Method

Mold wash drying need no longer be an all-night or all-day job. While molds must be dried properly by some means to give the surface hardness needed to produce smoothest casting surfaces, penetrating far-infrared electric heat speeds up the process greatly. Heating by this method is by conveyor, saving all the handling labor and floor space normally required to stack molds for air drying.

Ohio Steel Foundry, at Springfield, Ohio, for example, now dries silicone wash on molds for gear castings in 7½ min by means of a single bank of 24 heaters, rated at 1.8 kw each, suspended over the conveyor carrying the molds. During drying, the heaters are lowered to within a few inches of the top of the molds, but when not in use they are raised to the ceiling.

Only the drag half of each mold is sprayed with the silicone wash in this operation. The cope is not sprayed because it contains very little cavity and none of the gear tooth surface. About 25 drag molds are dried per hour. After drying, they are cooled by a fan at the end of the heating line. This prevents condensation from forming and permits immediate mounting of the cope and pouring of the mold.

(Continued on page 122)

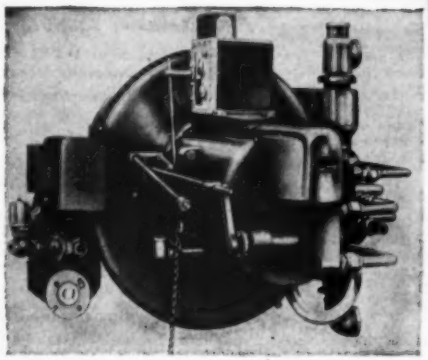
NO MATTER WHAT THE DEMAND

THERE'S A

Petro

INDUSTRIAL OIL BURNER

to handle it!



Shown above Model WA for use with cold oil.
Also available Model W-AH for use with heated oil.

Model G-W Combination oil-gas.

Cut Fuel Costs with Heavy Fuel Oil

Petro rotary oil burners are built for firing all types of boilers up to 600 boiler horsepower, and also for many other industrial applications. They are designed to burn the low-cost, heavy fuel oils with complete reliability, Petro oil burners slash fuel costs two ways—they burn the *lower priced oils*, and they do it with *outstanding efficiency*. Fluctuating steam demands are answered automatically with Petro modulating flame control. Thousands of owners will tell you that Petro Industrial Oil Burners and combination oil-gas burners are fuel savers, labor savers and trouble savers, and their dependability is traditional.

Your heating contractor can tell you about Petro burners. Turn to "Oil Burners" in telephone book yellow pages. See catalog in Sweet's Architectural File, or mail coupon below.

INDUSTRIAL AND COMMERCIAL OIL, GAS AND COMBINATION OIL-GAS BURNERS, RESIDENTIAL OIL BURNERS, OIL AND GAS FURNACES AND BOILERS

PETRO

T.M. REG. U.S. PAT. OFF.

50 Years of Leadership in Automatic Heating and Power Equipment

PETRO, 3214 W. 106th St., Cleveland, Ohio.
In Canada: 2231 Bloor Street, West, Toronto, Ontario.

Please send me the Petro catalog of commercial-industrial oil and gas-oil firing equipment.

Name_____

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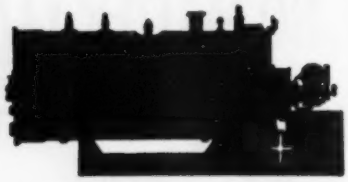
HOW SUPERIOR SOLVES YOUR STEAM PROBLEMS

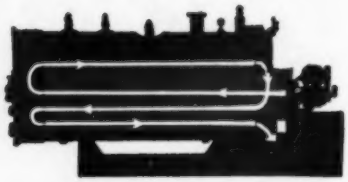
A COMPLETE PACKAGE

Completely factory-assembled and tested, a Superior Steam Generator is backed by undivided responsibility.



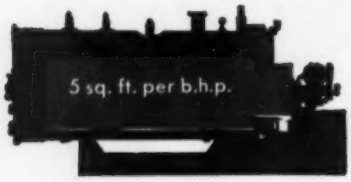
INDUCED DRAFT THAT'S BUILT-IN

...eliminates need of an expensive chimney... Multiple fans draw evenly on all tubes, reducing maintenance.



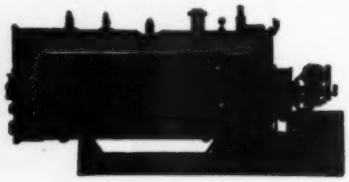
4-PASS, DOWN-DRAFT DESIGN

High gas velocities produce high efficiency. Down-draft design promotes rapid evaporation, quicker steaming.



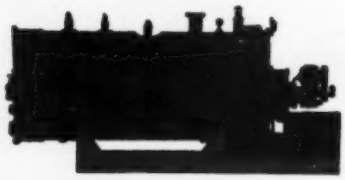
AMPLE HEATING SURFACE

A minimum of 5 sq. ft. of heating surface per boiler horsepower assures maximum efficiency at full rated capacity.



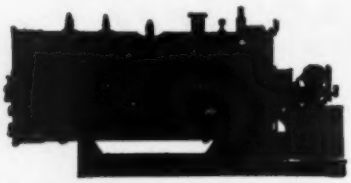
RESERVE CAPACITY

Greater steam space and large evaporating surface provide ample reserve capacity & better than 99% dry steam.



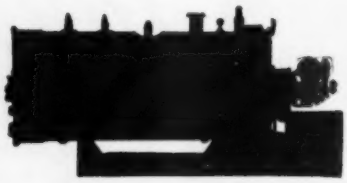
NO EXPENSIVE FOUNDATION

Built on a rigid channel iron base, a Superior Steam Generator needs only a floor capable of supporting its weight.



BUILT-IN CONTROLS

All controls essential to completely automatic operation are factory-wired into an easily accessible control panel,



BURN OIL, GAS, OR BOTH

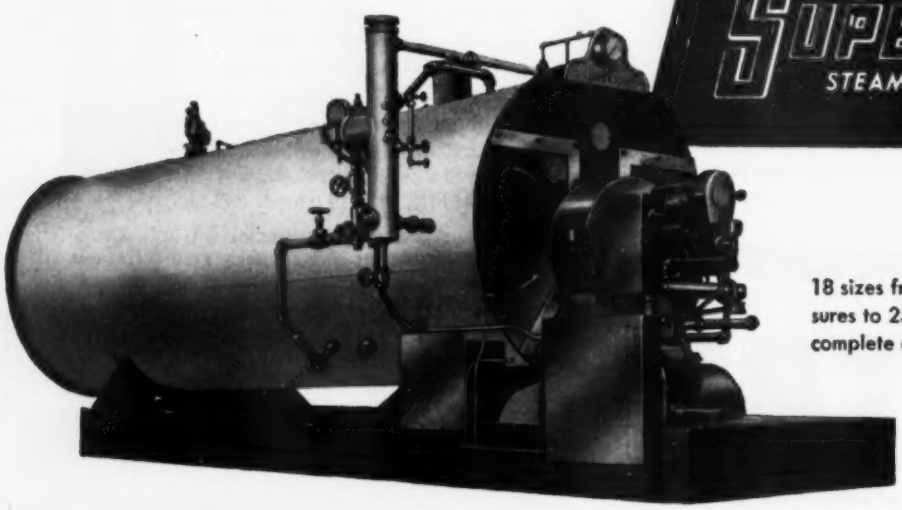
Superior Burners burn oil or gas or a combination of both... changing from one fuel to the other in seconds.

Superior Steam Generators are the ideal choice for a new steam plant... the simplest answer to expanding your present plant... the easiest solution to replacing obsolete boilers.

Guaranteed to develop maximum rated capacities at thermal efficiencies in excess of 80%, their design embodies features which insure long-lived dependability and maximum fuel economy.

for performance you can **BANK** *on*

SUPERIOR
STEAM GENERATORS



18 sizes from 20 to 600 b.h.p. for pressures to 250 p.s.i. or for hot water. For complete details write for Catalog 502.

SUPERIOR COMBUSTION INDUSTRIES INC. TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

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bulletins

. . . for listing of other bulletins just received see page 38

AIR FILTERS & DUST COLLECTORS

240—Dust Collectors

Dust collectors, including cyclone, wet or dry dynamic, and cloth screen arrestor types are the subject of a 32-page bulletin. Uses of air conditioning, ventilating, conveying, drying, and cooling units are presented by means of illustrated industrial installations. Kirk & Blum Mfg. Co.

244—Industrial Dusts

"The Collection and Recovery of Industrial Dusts," 32-page manual 101, discusses various types of dust and techniques used in analysis, lists the factors which influence choice of equipment, and explains the operation of each type of collector. Buell Engineering Co., Inc.

PROTECTIVE COATINGS

248—Rust Preventive Coatings

Complete instructions for surface preparation and application of rust preventive coatings are given in a 16-page general catalog. Color chips are included for various types of coatings. Rust-Oleum Corp.

BOILERS & BOILER ACCESSORIES

252—Oil Burning Equipment

Detailed information on oil burners, combination gas and oil burners, oil pumps, and accessories in 20-page booklet 3048, explains how to select a burner, engineering and manufacturing factors, use of panel or control boards. Petro Div.

256—Packaged Steam Generators

Construction of packaged steam generators is described in 8-page bulletin 1050. Auxiliary equipment is listed and a blueprint with dimensions of a typical boiler room layout is given. Ames Iron Works.

260—Spreader Stokers

Engineering data concerning spreader stokers installed to burn refuse or wood are contained in 24-page booklet 505. Stationary, manual dumping, power dumping, and traveling grate installations having maximum capacities from 10,000 to 275,000 lb steam per hr are described. Detroit Stoker Co.

264—Water Tube Boilers

Actual installations of 2-drum water tube boilers with integral water-wall elements are pictured in 20-page brochure SB43. Factory assembled units, up to 300 hp, are for underfeed stoker, spreader stoker, oil or gas firing as well as larger units for field erection. Erie City Iron Works.

268—Packaged Boilers

Packaged automatic boilers for light oil, heavy oil, gas, or combination gas and oil firing are featured in 16-page bulletin 1219. Ratings for 15 to 500 hp units are tabulated and installations for steam process and steam and hot water service are illustrated and described. Orr & Sembower, Inc.

272—Spreader Stokers

Reasons for firing with spreader stokers, together with distinctive design and operating characteristics of spreader stoker feeder units, are outlined in a 46-page brochure. Case studies point up construction details, advantages of traveling grate units, and installations. Riley Stoker Corp.

276—Coal-Burning Installations

"Burning Bituminous Coal the Modern Way," contains 24 pages of case histories from industries of all sizes and types. Engineering survey results for equipment such as boilers, stokers, coal and ash handling units, and automatic controls, include annual fuel consumption and operating costs. Bituminous Coal Institute.

280—Packaged Steam Generator

Described in a 4-page folder is the principle of Cyclonic combustion, a recently developed method of heat transfer employed in this packaged steam generator. Oil, gas or combination burners are available. Capacities are from 18 to 500 boiler hp. Cyclotherm Corp.

284—Oil Burners

Units with capacities from 5 to 60 gpm are described and illustrated in 8-page catalog Ad-102. Heavier grades of fuel oil, up to No. 5, can be utilized. Construction features, advantages, and specifications are given. Cleaver-Brooks Co., Hev-E-Oil Burner Div.

288—Water-Tube Steam Generators

Data and specification for factory assembled units in sizes ranging from 5300 to 33,000 lb per hr are presented in an 8-page brochure. For pressures up to 400 psi, they are designed to provide fully automatic firing with oil, gas, or stoker-fired coal. Superior Combustion Ind., Inc.

DIESELS & GAS ENGINES

292—Diesel Engines

Smaller and lighter, but for heavy-duty service, is the description of a diesel engine discussed in 12-page bulletin 10027. Three models are listed, ranging from 200 to 380 hp at 900 to 1000 rpm. Specifications and performance curves are included. Ingersoll-Rand Co.

296—Gas Diesel Engines

Engines for gas, gas-diesel, and diesel operation described in 12-page booklet L-71, are 4-cycle, with 15½ in. bore and 22 in. stroke. A rating curve compares supercharged to atmospheric operation. Aftercooling for more horsepower is discussed. Space requirements are listed and typical installations are shown. Cooper-Bessemer Corp.

ELECTRICAL EQUIPMENT

300—Commutators and Slip Rings

"Commutator and Slip Ring Maintenance," 39-page handbook, covers trouble shooting, brush maintenance and operating procedure, and general maintenance. Illustrations show the operations described. Ideal Industries, Inc.

304—Motor Controls

"Quality Line of Motor Controls for All Industries," 28-page catalog, describes construction of standard motor control apparatus including controls, starters, and accessories. Advantages and applications are pointed out. Allen-Bradley Co.

308—Distribution Practices

"Industrial Power Distribution Idea Book," GEA5900, 28-pages, has been published as a guide on distribution practices in large and small plants. General Electric Co.

316—Reference Book

"Motor and Generator Reference Book," 50-page manual 51R7933, presents information to assist in the selection of motive power to handle most industrial applications. It is reprinted from the 1952 edition of "Lincoln's Industrial-Commercial Electrical Reference." Allis-Chalmers Manufacturing Co.

320—Instrument Transformers

"Instrument Transformer Buyer's Guide," 102-pages, is designed for saving time in selecting and ordering current transformers, potential transformers, and metering

(Continued on page 108)

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NOTE — Each bulletin item has a key number for your convenience in asking for a free, personal copy. Circle key numbers on Reply Card between pages 106 - 107.

As much as
10 years' service
without replacement

That's only one of many records for

MOLDIT CASTABLES
in ash hoppers

✔ A large power plant had to repair a number of ash hoppers, remove spalled and shaled fire brick and replace with new material. Estimated cost—$30,000, plus considerable boiler outage. But R & I recommended thorough raking out, cleaning and wetting down of all broken, spalled and eroded areas, and the holes and openings filled and plastered with Moldit-D Refractory Cement to a smooth, level surface. This was done more than 10 years ago. Today the Moldit-D refractory is still in place, withstanding hard usage and frequent, large quantity cold water quenchings of the hot ash. All this at about one-fourth the estimated cost!

✔ Heavy repairs to ash hoppers with prolonged shut-downs used to cost another large power plant many thousands of dollars until they tried Moldit-D. As a result, maintaining these hoppers of eight 500,000-lb. stoker-fired boilers as well as a number of smaller boilers has been cut about 90% a year.

✔ The Moldit-D linings installed eleven years ago in ash hoppers of two 800,000-lb. pulverized fuel boilers are still going strong. Not a single repair has been necessary! The original application was made on the walls and ends of the hoppers, at a cost of a few cents per pound, plus very little labor. Figure this out in terms of labor and material for equivalent fire brick lining including the cost of maintaining and repairing it for eleven years. It would be staggering!

The Moldit success story is endless—wherever refractory linings are used. There's a Moldit Cement for every castable refractory need.

Pour It—Gun It—Trowel It—MOLDIT

REFRACTORY & INSULATION CORP.

R&I

REFRACTORY BONDING AND CASTABLE CEMENTS
INSULATING BLOCK, BLANKETS AND CEMENTS

130 WALL STREET • NEW YORK 5, N. Y.

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bulletins

(Continued from page 107)

equipment. Ratings and ASA accuracy classifications are tabulated for indoor and outdoor units. Listings of ratio and phase-angle tests, with tables covering mechanical and thermal limits of current transformers, are included. General Electric Co.

FANS & BLOWERS

324—Blowers and Exhausters

Design and performance features of multistage centrifugal blowers and exhausters for pressures from 1 to 9 psi, and vacuum from 2 to 12 in. Hg, are appraised in 2-page data sheet A-932. Industrial applications are listed, including several in which savings can be made by replacing compressed air formerly considered necessary. Air Appliance Div., U.S. Hoffman Machinery Corp.

328—Ventilating Fans

Description of many types of fans and blowers are presented in 30-page catalog 400, along with engineering data on how to select and install the proper fan. Chelsea Fan & Blower Co., Inc.

332—Centrifugal Blowers

Descriptive material on centrifugal blowers, manufactured by this company, is included in 24-page catalog B-10. Dimension drawings and complete air delivery tables are given for each model. Hartzell Propeller Fan Co.

TO REQUEST FREE BULLETINS

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FILTERS, STRAINERS, & PURIFIERS

336—Filters

Replaceable cartridge filters for clarification of many fluids and gases are the subject of 4-page folder PJL-0351. Details of construction, operation, and applications are discussed, as well as specifications and tables of capacities and dimensions. The Cuno Engineering Co.

340—Twin Strainers

Twin Strainers for filtering foreign matter from oils, greases, tar, glue, sugar juice, and similar viscous fluids are described in 4-page leaflet, A-17. They are available with inlet sizes from 1 through 10 in. for working pressures to 500 psi. Elliott Co., Accessories Dept.

HEAT EXCHANGER EQUIPMENT

344—Heat Transfer Equipment

Various types of heat transfer equipment are among the products described in 12-page catalog 12. Also presented are various types of dry blending equipment and such process equipment as kettles, evaporators, vessels, reactors, and coils. The Patterson-Kelley Co., Inc.

348—Heat Exchangers

A simple method of controlling the temperature of liquid or gas is explained in 4-page folder 120 on heat exchangers. Cutaway drawings illustrate how the units

(Continued on page 110)

For expansion or replacement

you get a better buy

with the

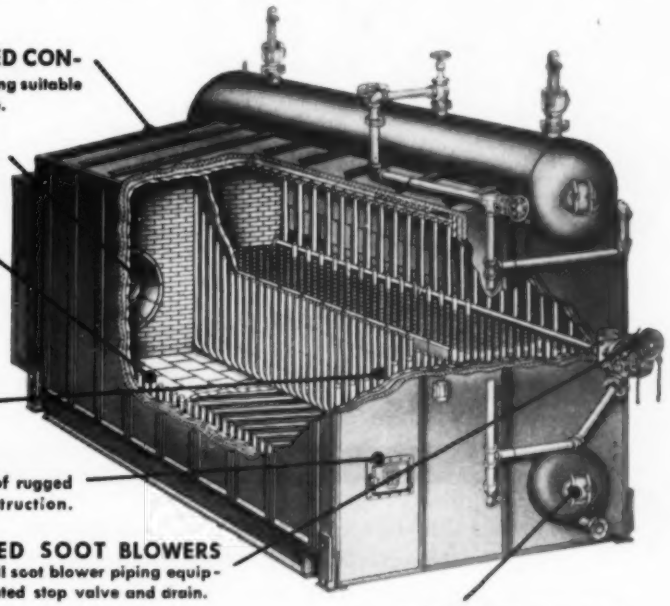
FW PACKAGE STEAM GENERATOR

If you are planning a new plant, expanding production or want greater efficiency through replacement of your present steam generator, it will pay you to "look into" the Foster Wheeler Package Steam Generator.

For process steam, heating, or "on-the-spot" construction steam, these highly efficient, plant-assembled, water-tube steam generators produce savings in installation, operation and maintenance. They are available in capacities from 7,500 to 35,000 lb of steam per hr. Design pressures are 250, 525 or 825 psi. Multiple-unit installations are practical and economical up to 150,000 lb per hr.

• • •

For low-cost steam "where you need it—when you need it", you get a better buy with the Foster Wheeler Package Steam Generator. For more detailed information, write to Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.



ALL STEEL WELDED CONSTRUCTION of casing suitable for outdoor installation.

TWO BURNERS on units over 20,000 lb per hr. All burner registers are hinged to permit easy access to diffuser and register louvers.

FURNACE WATER WALLS backed with 2" first quality fire clay tile, 2" block insulation and 2½" rock wool blanket.

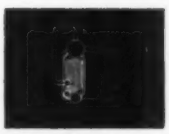
REAR FURNACE WALLS are water cooled for full height of furnace, tie in to boiler circulation without use of headers.

HINGED ACCESS DOORS of rugged refractory lined cast iron construction.

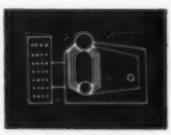
DOUBLE - ENDED SOOT BLOWERS on the larger units. All soot blower piping equipped with chain operated stop valve and drain.

MANHOLES at both ends of each drum for capacities in excess of 15,000 lb per hr.

FEATURES THAT DISTINGUISH FOSTER WHEELER PACKAGE STEAM GENERATORS

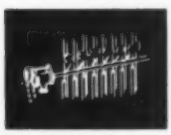


HIGH STEAM TEMPERATURES. Provisions for superheaters in some designs.



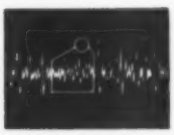
ECONOMIZERS. For larger capacity installations, package economizers can be supplied to provide minimum fuel costs.

ACCESSIBILITY. For inspection, cleaning, maintenance.



CLEAN HEATING SURFACES. Soot blowers incorporated . . . cleaning without boiler shutdown.

HEAT LOSS MINIMIZED. Minimum heat loss — from radiation and air infiltration.



RAPID LOAD SWINGS. Large diameter drums and ample furnace heating surface.

FOSTER WHEELER

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Dart Unions are leakproof because they're precision-machined to a true ball joint . . . then spherically ground for *wide*, true-bearing surfaces. If you want no leaks — you want Darts!

QUICK FACTS

- Extra wide bronze seats (Resist pitting and corrosion)
- Heavy shoulders (Take severe wrenching in stride)
- Nut and Body Practically Indestructible (They're air-refined, high test malleable iron)

See your supplier *today*.

DART UNION COMPANY
Providence 5, Rhode Island
The Fairbanks Co. — Distributors
Boston New York Pittsburgh

DART UNIONS

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bulletins

(Continued from page 108)

operate and, flow diagrams show how controls keep a fluid at uniform temperature. Niagara Blower Co.

HEATING, AIR CONDITIONING, & REFRIGERATION

352—Electric Comfort Heaters
Listed in 8-page catalog D-52 are 75 different models of forced air, convection, and radiant heaters in capacities of ¼ to 100 kw. Aids include a quick selector chart which shows how to calculate heat requirements for given areas and types of building construction. Edwin L. Wiegand Co.

INSTRUMENTS & CONTROLS

364—Mold Temperature Control
Discussed in 8-page technical bulletin 7 is the problem of maintaining proper temperature control of injection molding equipment. Included is a chart which lists the mold difficulties which occur with various thermoplastics when the temperature is too high or too low. Features of a heating and cooling unit are detailed. Sarco Co., Inc.

368—Regulators
"How to Select Regulators," a 40-page booklet, provides useful data for simplifying the selection of pressure regulators, temperature regulators, or pump governors to do a specific job. Steam, gas, and water capacity tables, together with suggestions for installation and other pertinent information make this a useful reference. Foster Engineering Co.

372—Control Centers
"Why a control center?" In answering this question, 32-page handbook B-5621 points out characteristics that make for flexibility of application, ease of servicing, and safety of operating personnel. Information is included to aid in selecting the right control center arrangement and starter size. Westinghouse Electric Corp.

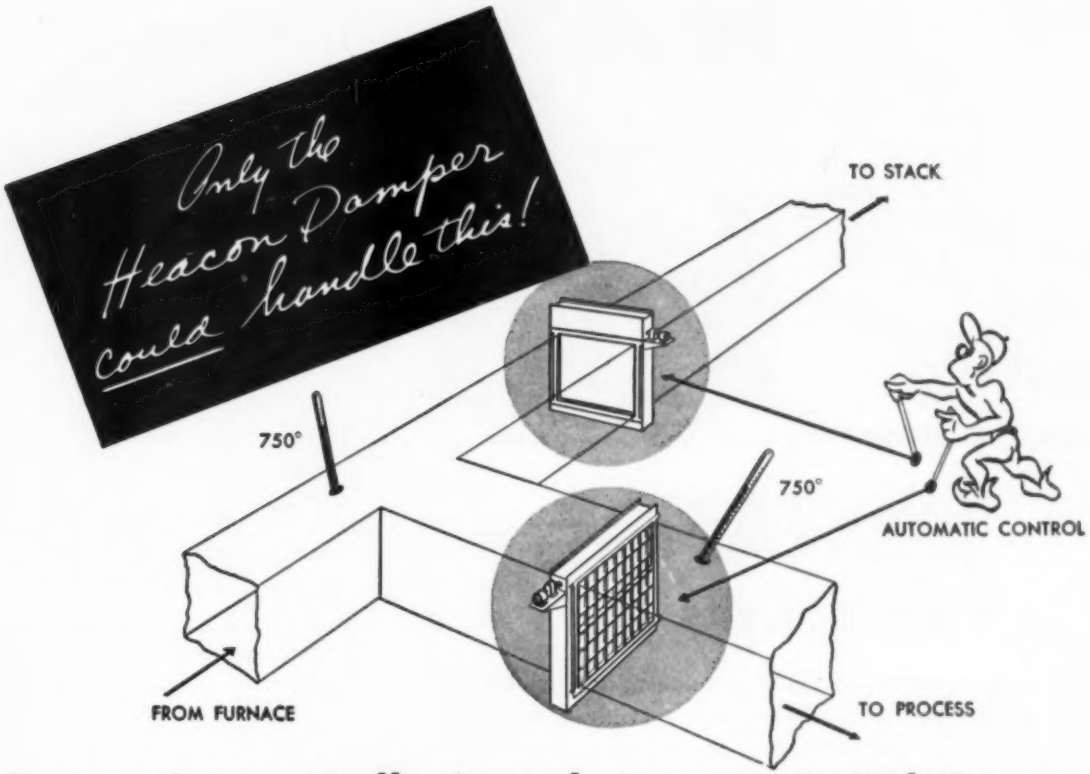
388—Instrumentation
Illustrated 8-page booklet R-8, entitled "Results," presents the case histories of a large independent electric power producer. In addition to discussions of the use of steam, fuel and ash handling, and plant steam demand, the combustion control system is also fully described and illustrated. The Hays Corp.

LUBRICANTS & LUBRICATION EQUIPMENT

392—Lubricating Oil
Excellent time-temperature characteristics, and application by any method are advantages listed in technical data sheet 17, for newly developed lubricating oils. Physical properties and other advantages are discussed, and a chart shows service life characteristics. Sun Oil Co.

396—Force Feed Lubricator
High pressure force feed lubricators, designed for service at pressures to 30,000 psi, are dealt with in 12-page catalog 25G. Tables show output, dimensions, and specifications. Information is given on how to order the correct unit and fittings. Manzel Div., Frontier Industries, Inc.

(Continued on page 112)



Damper *Automatically* Controls Dangerously High Temperatures

. . . Safeguards Expensive Processing From Contamination

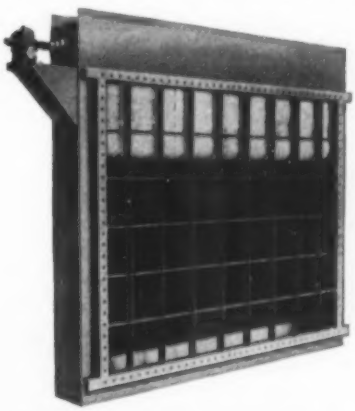
In this installation the safety and success of a new process depends on two factors:
1. Automatic control of high temperatures.
2. Assurance of safety when temperatures approach danger zone.

The process would be impossible without instantaneous and tight shut-off of heat to process and without automatic and dependable venting of heat to the stack. Damper leakage here could mean the loss of thousands of dollars in processing time and materials—not to mention the possible destruction of the plant and its personnel!

Temperatures and pressures had to be under quick, fool-proof control. That's why Heacon Dampers were specified. *Heacon is the only damper made that can assure the positive tightness and control so necessary in this installation!*

The Heacon Damper is a radical departure from conventional damper design. There are no louvers to leak . . . no possibility of warpage. The greater the pressure the more tightly it seals!

Heacon Dampers are designed and constructed to meet practically any pressure or temperature specifications. Our engineers will be glad to discuss your problems with you.



Project Engineers

THE THERMIX CORPORATION

GREENWICH, CONN.

Canadian Affiliates: T. C. CHOWN, LTD., 1440 St. Catherine St., W., Montreal 25; Quebec, 983 Bay St.; Toronto 5, Ontario, Canada

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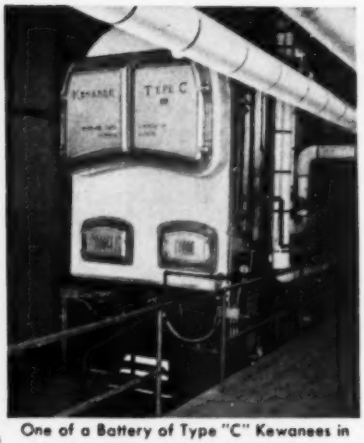
MORE ENGINEERING
MORE MATERIAL
MORE EXPERIENCE

MAKE THE DIFFERENCE



One of a Battery of Type "C" Kewanees in The Hecht Company Store, Arlington, Va.

KEWANEE
STEEL BOILERS

84 years experience in designing and building steel boilers provides an accumulated knowledge sure to result in boilers of unusual economy and dependability.

More material and labor also play their part in making Kewanee Boilers different and better. "Skimp" on steel and the boiler can't be big enough to do its job . . . use lighter weight plate and strength and durability are reduced. More goes into Kewanee Boilers, so the owners get more from them. That's why they are universal favorites for generating dependable, economical heat or power.

In designing and equipping their "Parkington" store, The Hecht Company applied its vast retailing experience to provide the utmost in shopping convenience and comfort. Modern features include 127 complete departments; air conditioning; high speed elevators and motor stairs; fluorescent lighting; accoustical ceilings . . . and for the important job of heating . . . Kewanee Boilers.

KEWANEE-ROSS CORPORATION
Division of American Radiator & Standard Sanitary Corporation
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KEWANEE BOILERS

THE HECHT COMPANY, Store
Arlington, Virginia
Design of entire project, under direction of
ABBOTT, MERRKT & CO., Engineers, New York
KAHN & JACOBS, Associate Architects
EDWARD E. ASHLEY, Associate Engineer
Oil Fired Kewanee Boilers installed by
R. M. THORNTON, Washington, D. C.

Serving home and industry

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bulletins

(Continued from page 110)

MATERIALS OF CONSTRUCTION

400—Nickel Alloys

Helpful technical publications covering the many aspects of nickel alloys, and their applications, are listed in 2 bulletins. Instructions on how to order literature, free of charge, are included. The International Nickel Co., Inc.

MATERIALS HANDLING EQUIPMENT

408—Screw Conveyors

How screw conveyors and screw feeders are used to convey, elevate, heat, cool, and mix many different types of materials is discussed in 92-page handbook 2289. Detailed information, including selection tables, horsepower formulas, layouts, and specifications, aids in selecting equipment for many types of applications. In addition to helicoid flight and sectional flight conveyor screws, types designed for special conditions are described. Link-Belt Co.

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MECHANICAL POWER TRANSMISSION

412—Electric Clutch

Principles of operation of an electrically controlled clutch are explained in 16-page bulletin 5306. It gives engineering information on how to apply, how it operates, and control. Specifications are listed. Rectifier Div., I-T-E Circuit Breaker Co.

416—V-Belts

Fractional horsepower V-belts, for use in servicing light duty applications, are cataloged according to the new industry-standard numbering system. Various types of machines are listed alphabetically by company or trade names for convenience in determining the proper belt. Manhattan Rubber Div., Raybestos-Manhattan, Inc.

PACKING & GASKETS

424—Metallic Packings

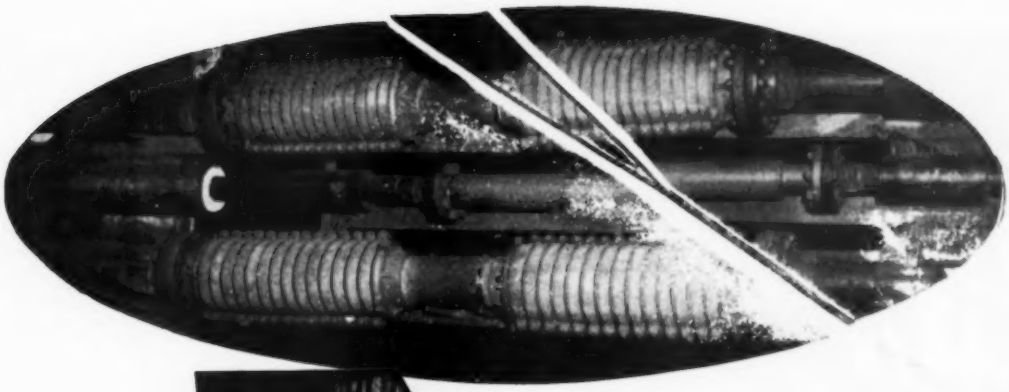
Included in an 8-page leaflet are service recommendations for "V" metal insert packings, metallic valve stem, plastic core metallic face, all metallic, flexible metallic, high temperature aluminum, and braided copper packings. Standard sizes, packages, and approximate weights for each type are also listed. Raybestos-Manhattan Inc., Packing Div.

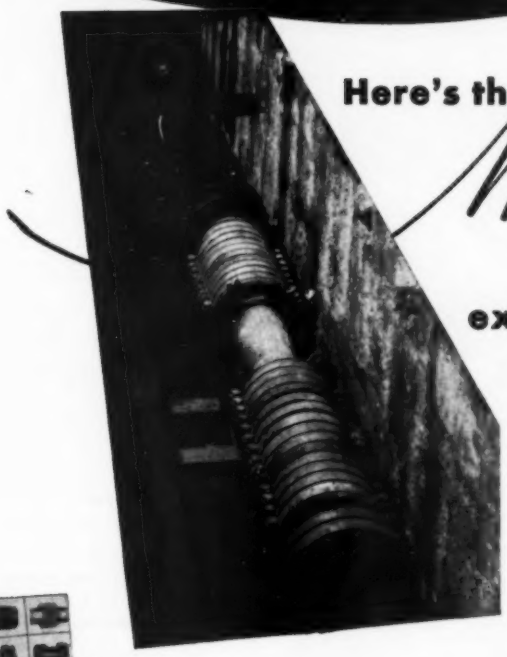
PIPE, TUBING & HOSE

430—Exhaust Hose

Flexible metal hose for diesel exhaust or intake lines, and misalignment or vibration connections is featured in 4-page catalog CMH-124. Also described are connections for oil, air, and fuel lines. Specifications are in tabular form, and illustrations include cutaways and photos of installations. Chicago Metal Hose Corp.

(Continued on page 114)





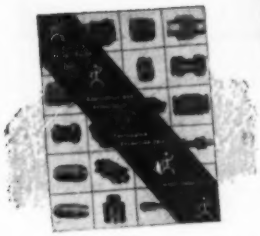
Here's the *Modern way*

to control piping expansion and contraction—

FLEXON

EXPANSION JOINTS

save space . . . require no maintenance . . . save time and money!



Here's your guide to PIPING MOTION CONTROL

The Flexon Expansion Joint Design Guide gives detailed specifications, and selection and application data for Flexon Expansion Joints. Write for your copy or see Flexon Expansion Joint Catalogs in Sweet's, Chemical Engineering Catalog and The Refinery Catalog.

You can have all the advantages of leakproof, maintenance-free pipeline motion control in a compact, easy-to-install, in-line unit when you use Flexon Expansion Joints. There is no repacking . . . no bulky, space-consuming installation . . . just install the Flexon Expansion Joint as easily as putting in a fitting, and then forget it.

Flexon Expansion Joints are offered with stainless steel or copper pressure carriers in Controlled-Flexing, Free-Flexing or Flexoniflex types. Units are available for pressures up to 5500 psi, temperatures to 800° F. (1600° F with special alloys). All types suitable for handling radial, axial and/or lateral pipe motion.

Write for the name of your nearest Flexonics representative.

Flexonics *Corporation*

EXPANSION JOINT DIVISION

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FORMERLY CHICAGO METAL HOSE CORPORATION

In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

Flexon identifies products of Flexonics Corporation that have served industry for over 50 years.

Flexible metal hose

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Aircraft components

Metallic bellows

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Cut nut-running time 75%

Snap-on* Electric IMPACT WRENCH

The fastest wrench you can put in the hands of a maintenance or production worker. Swiftly runs nuts or screws on or off—cuts costs—makes tough jobs easy. The Snap-on impact wrench delivers up to 2,000 powerful rotary blows a minute without twist or hammer shock to operator. Sets nuts solidly, or quickly reverses to break tough ones loose. ½" square drive takes sockets ⅜" to 1 1/16"—many accessory tools available. 2 models—115 volts, 220/230 volts. Available through Snap-on factory branch warehouses in principal industrial centers. Write for Snap-on Industrial catalog and new catalog of 4,000 hand and bench tools for production and service.

SNAP-ON TOOLS CORPORATION
8102-J 28th Ave., Kenosha, Wis.

*Snap-on is the trademark of Snap-on Tools Corporation.

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bulletins

(Continued from page 112)

432—Pressure Clamps
Universal pressure clamps which can handle permanent or emergency clamping jobs from ½ in. to 30 ft dia are described in detail in 6-page bulletin 50M. Drawings show how the clamps are applied and where they may be used. A portable repair kit which holds 900 clamps of any diameter in 1 cu ft of space is shown. Band-It Co.

433—Wrought Iron Pipe
Contained in 4-page bulletin 27aBy is a handy radiant heating conversion chart along with suggested applications of wrought iron pipe. Consolidated tables list dimensions, threads per in., mill test pressures, length per sq ft of surface area, length per cu ft of volume, and gal per linear ft of standard weight and extra strong pipe. The analysis and physical properties of wrought iron are also tabulated. A. M. Byers Co.

PUMPS & COMPRESSORS

436—Controlled Volume Pumps
Design features and construction of motor-driven controlled volume pumps are detailed in 40-page booklet 553. Technical data include capacity adjustments, standard and special designs, and packaged systems. A 2-page chart describes typical applications in 6 major industries. Milton Roy Co.

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439—Opposed Impeller Pump
How opposed impellers balance axial thrust is covered in 12-page brochure 1502. Sizes from 2 to 4 in., with 2 to 8 stages, are presented for capacities to 1000 gpm, pressures to 1200 psig, and temperatures to 350 F. Typical applications are tabulated. De Laval Steam Turbine Co.

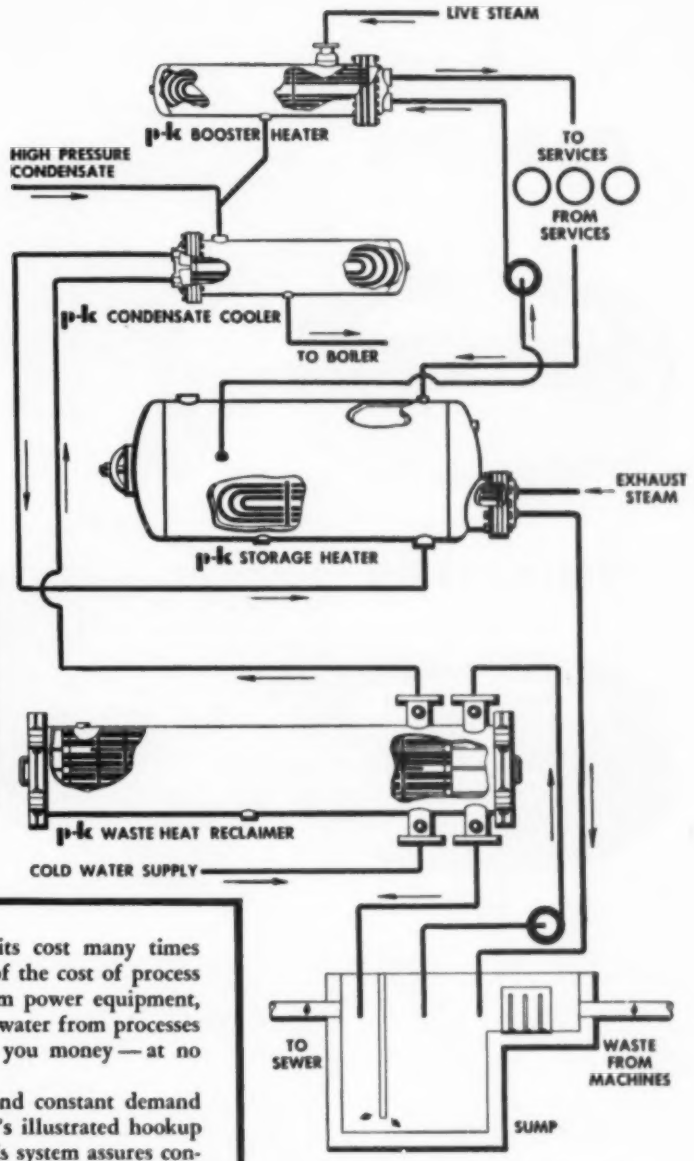
442—Compressors
Basic application data and design specifications for multi-stage, multi-cylinder compressors from 100 to 5000 hp are contained in 44-page engineering catalog M-70. Helpful discussions include design features, lubricating system, bearings and counterweights, cylinders, motors and drives, automatic control, and typical installations. The Cooper-Bessemer Corp.

445—Air Compressors
Descriptions, design features, and specifications for industrial air compressors are contained in 16-page brochure 5110-A. Models are for belt or direct motor drive from ½ to 100 hp. Accessories and controls also are described. Schramm, Inc.

448—Rotary Pumps
Heavy duty rotary pumps are the subject of 16-page bulletin W-483-B2. Construction and specifications are given for herringbone gear types with capacities to 5000 gpm and pressures to 500 psi, and a sliding-vane type rated to 100 gpm and 200 psi. Applications and typical driving arrangements are pictured. Reciprocating Pump Div., Worthington Corp.

(Continued on page 118)

how to exchange heat and save half your fuel dollar



p-k hot water supply system — one of numerous variations — for maximum heat recovery in processes using large quantities of hot water.
Whether your operation is in the textile, chemical, laundry, pulp and paper fields, or any field where hot water is required, **p-k** can recommend the proper recovery system for optimum heat balance.

p-k equipment can earn its cost many times over, save 50% and more of the cost of process heating. Exhaust steam from power equipment, or condensate or waste hot water from processes — can go to work saving you money — at no added operating cost.

When there is a large and constant demand for hot process water, **p-k**'s illustrated hookup No. 1 is recommended. This system assures control of temperatures, pressures and velocities at all plant stations. Substantial increases in production can be made without additional equipment.

p-k reclaimers, storage heaters, condensate coolers, booster heaters, etc. are available in many standard sizes and types to meet most industrial or commercial requirements.

Learn more about the sure savings available to you — write now for complete information. Ask for Cat. No. 310. Further information and engineering assistance will be gladly provided without obligation.

the Patterson-Kelley Co., inc.

1200 Burson St., East Stroudsburg, Penn.

101 Park Avenue, New York 17 • Railway Exchange Building, Chicago 4 • 1700 Walnut Street, Philadelphia 3 • 96-A Huntington Avenue, Boston 16 • and other principal cities

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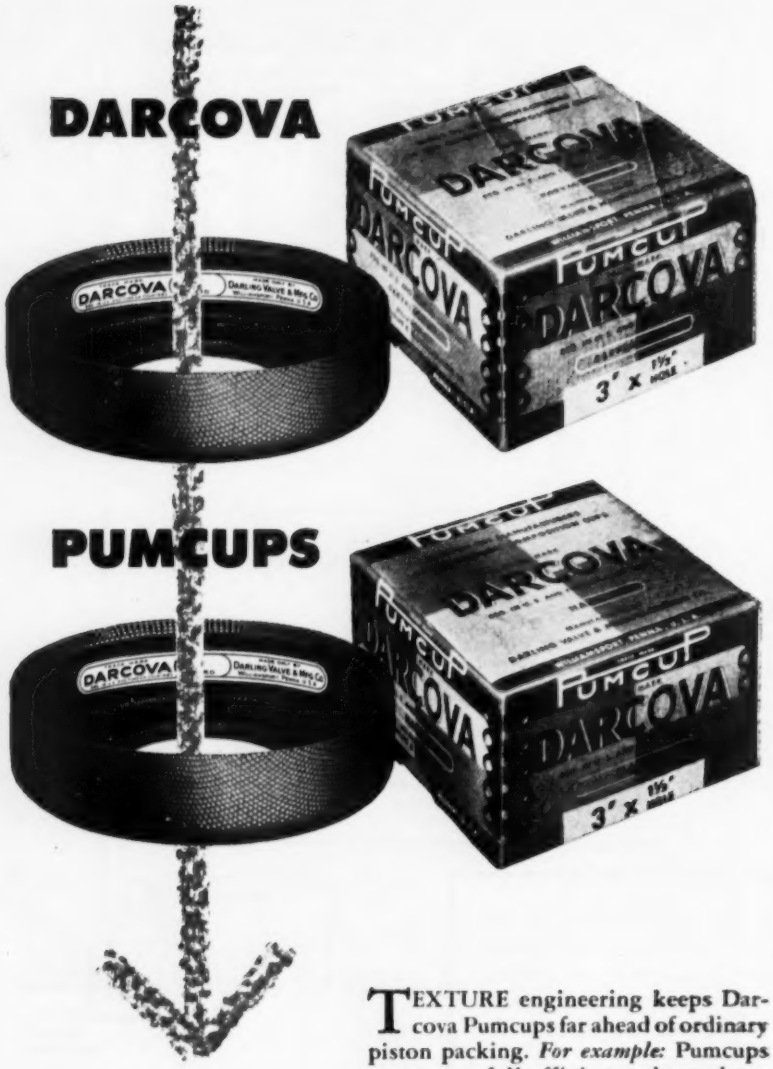

...famous for

- PUMPING EFFICIENCY
- LOWER COST
- LONGER SERVICE

TEXTURE engineering keeps Darcova Pumcups far ahead of ordinary piston packing. *For example:* Pumcups operate at full efficiency throughout their entire life. Fluid slippage is virtually eliminated.

Moreover, you can count on much longer service . . . users report Darcova Pumcups outlast other packing at least 3 to 1!

Write for all the facts on Darcova efficiency: Bulletin No. 4502 on Pumcups for air and hydraulic mechanisms; No. 4401 on Pumcups for reciprocating pumps.

DARLING VALVE & MANUFACTURING CO.
Williamsport 9, Pa.

DARCOVA THE ORIGINAL COMPOSITION CUP PUMCUPS

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bulletins

Continued from page 114)

451—Vertical Pumps

"Vertical Pumps for Volatile Fluids," 6-page folder 1026, appraises the advantages of vertical turbine pumps for handling such liquids as gasoline, diesel fuel, crude oil, L-P gases, and ammonia. Efficiency curves are included in the engineering data. Johnston Pump Co.

454—Vertical Turbine Pump

Inherent characteristics of vertical turbine pumps are briefly described in 12-page bulletin W-450-B41. Case history studies emphasize their usefulness in deep well work, to move water from surface sources, for recirculating cooling water, and for condensate return, booster service, and fire prevention. Worthington Corp.

457—Chemical Feeder

Construction and advantages of a heavy duty, positive displacement, diaphragm pump, designed to feed corrosive fluids used in industrial processes, and in treating water and sewage, are stressed in 4-page folder 12-1. A table lists a few of the chemical solutions and concentrations that can be handled. Operating data and a performance curve also are given. %Proportioneers, Inc.%.

460—Pump Valves

Pump valves and graphite packings are delineated in 24-page brochure SC-510. Types, details of construction, design features, applications, how to order, and dimensions are included. Heaters for heating water by blending with steam are also presented. Sims Pump Valve Co., Inc.

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463—Centrifugal Pumps

"How to Figure Pumping Head," is a particularly useful section of 24-page bulletin 08B614B. Construction features of single-stage, double-suction pumps are detailed, and applications for the units are suggested. Various types of drives are listed along with tables of available sizes, approximate dimensions, and head capacities, and a tabulation of friction loss of water per 100 ft of pipe. Allis-Chalmers Manufacturing Co.

REFRACTORIES

466—Refractories & Insulations

Catalogs R-52 through I-93, compiled in a binder, form an illustrated 40-page booklet showing where, when, and how to use various types of materials for industrial heat generation and processing equipment. An index is included for quick reference. Refractory & Insulation Corp.

STEAM SPECIALTIES

469—Separators & Purifiers

Live steam, exhaust steam, air and gas, and receiver type separators, and steam purifiers and exhaust heads are described in 24-page catalog 500. Charts give pressure drop, steam capacity, and air capacity. Wright-Austin Co.

(Continued on page 118)

Putting STEAM to Work with a Class H Compressor

Chicago Pneumatic's horizontal duplex, Class H steam-driven compressor brings real operating economies to plants where low cost steam or exhaust steam is available. Economical steam end proportioned to plants' steam conditions, automatic cut-off governor, and Simplate valves are just a few of the many outstanding features that add to the machine's long, dependable life and high overall efficiency.

Capacities range from 900 to 7400 cfm. (100-125 lb. air, 200 to 1250 hp). Other types and sizes available for lower and higher pressures.

Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, New York.

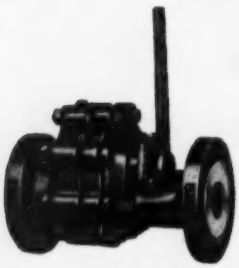
Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

Circle 571 on Reply Card for more data

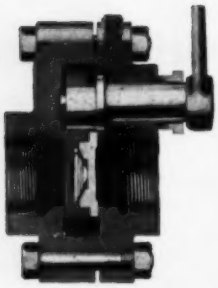
EVERLASTING VALVES

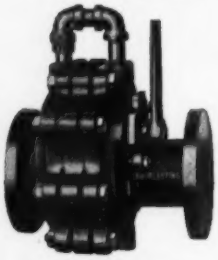
mean "EVERLASTING" PROTECTION on these duties



GENERAL SERVICE

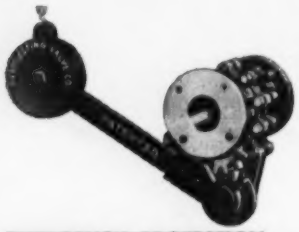
Wherever frequent use and quick operation is required for any liquid or gas at pressures up to 300 psi. These valves have outside stuffing box and gland.





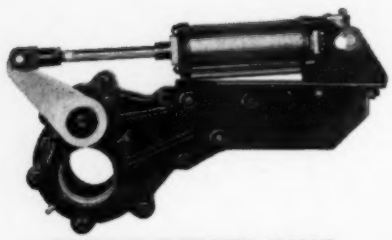
STEAM JACKETED

Assure continued free flow of any material which congeals at ordinary temperatures.



EMERGENCY PROTECTION

Closing type for inflammable liquid emergency shut-off, or opening type for deluge or drainage, assuring immediate and positive action with weighted pendulum stop.



CYLINDER-OPERATED VALVE

for accurate control of process work. Straight-through flow, drop-tight seal, air or hydraulic control for operation at any speed.

EVERLASTING FEATURES

For more than 40 years, EVERLASTING VALVES have been known for their ingenious design, simple sturdy construction, and long trouble-free life with low maintenance expense. Some of their distinctive features are:

Quick Action... opened or closed with less than a quarter turn of the operating lever.

Straight-Through Flow... the disc cannot become loose and accidentally check the flow.

Drop-Tight Seal... constant contact of disc and seat at all times prevents dirt or scale from getting between.

Self Regrinding... the disc rotates on the seat with each operation, thus regrinding the sealing surfaces.

No Wedge Action... all parts move between parallel faces.

EVERLASTING VALVE COMPANY, 49 FISK STREET, JERSEY CITY 5, N. J.

Everlasting Valves

TRADE MARK "EVERLASTING" REG. U.S. PAT. OFF.

FOR EVERLASTING PROTECTION

Circle 572 on Reply Card for more data

bulletins

(Continued from page 116)

472—Compound Steam Traps

Piston-operated traps for draining equipment producing large amounts of condensate, such as purifiers, separators, evaporators, and desuperheaters, are discussed in 8-page bulletin 215. Construction, operation, and installation are covered. Armstrong Machine Works.

475—Unit Heater Steam Traps

The question of how to figure condensing rates and select proper steam traps for draining unit heaters is answered in 8-page booklet 231. Output ratings for heaters from various manufacturers are listed, and constants are given for conditions other than specified. Armstrong Machine Works.

478—Steam Accumulators

Balancing steam supply and demand with steam accumulators is the subject of 8-page bulletin RA-52-8. Typical installations, principles of operation, and advantages are discussed, and data are presented for calculating capacity. Foster Wheeler Corp.

484—Welded Floats

Units made of stainless steel, monel, and chrome plated steel, in spherical, eliptical, and cylinderical shapes are presented in 8-page bulletin 753. Sizes from 2 to 14 in. dia for pressures from vacuum to 4800 psi are listed with weights, buoyancies, and collapsing pressures. W. H. Nicholson & Co.

TO REQUEST FREE BULLETINS

Insert "key" numbers on Reply Card between pages 106 and 107. Your requests will be handled promptly.

THERMAL INSULATION

488—Insulation Specifications

Engineers who must specify thermal insulations in oil refineries and chemical process plants should find a useful source of quick reference in 52-page brochure IN-128A. Specifications are listed for thermal insulations on various types of equipment. A complete service, including materials, engineering, and application is offered. Johns-Manville.

TOOLS

490—Condenser Tube Inserts

How to restore leaking condenser tubes to service by sealing off the deteriorated portion with inserts, is the subject of 4-page leaflet 500. Tube cleaners, expanders, and maintenance tools are listed. Thomas C. Wilson, Inc.

VALVES & REGULATORS

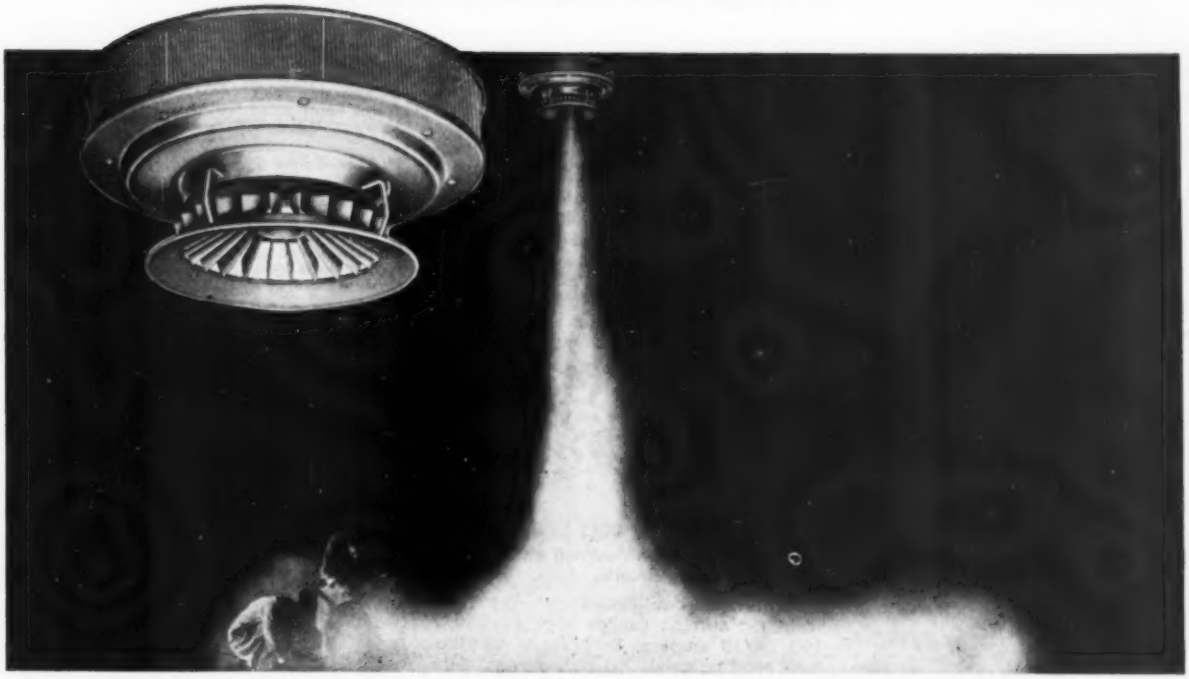
491—Regulating Valve

How control function of a pilot-operated valve can be changed by using a different sensitive pilot is explained in 4-page folder 700. A large cutaway illustration of the valve and a detailed description of design features are included. Spence Engineering Co., Inc.

(Continued on page 120)

DRAMATIC SMOKE TESTS PROVE . . .

you can produce unlimited heating patterns with a single Trane Projection Heater



1 Smoke tests show how you can throw heat down to worker level in a concentrated stream. The patented Louver Cone Diffuser makes the difference.

With the diffuser you can mount this TRANE Projection Heater as much as 60% higher in craneways, aisles and bays. It reclaims waste ceiling heat . . . pinpoints warmth on work areas far below.

2 To spread a gentle flow of heat over a wide area, simply close the Louver Cone blades. The TRANE Projection Heater then turns the heat outward from the top of the Louver Cone.

3 Without a diffuser, heat is forced down with a swirling motion . . . diffuses rapidly. This powerful standard unit becomes far more versatile when you add the Louver Cone Diffuser.

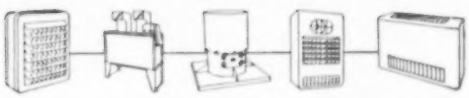
4 To flood an assembly line or general production area with a constant flow of warm air, adjust the individual Louver Cone blades at angles to deflect the heat to match the area below.

5 To warm two areas at once, you can adjust the Louver Cone blades to pinpoint part of the heated air straight down, yet diffuse the remainder outward in any direction you wish.

Laboratory smoke tests show graphically the versatility of TRANE Projection Heaters. With simple fingertip adjustments you can set the exclusive Louver Cone Diffuser to warm dozens of hard-to-heat factory areas in winter . . . provide better air circulation in summer. For complete information, write for free bulletin DS-327B.

Spot heat where you need it with . . .

TRANE Unit Heaters



Model H Unit Heater | Torridor | Ventilating Heater | Gas-Fired Unit Heater | Force-Flo Heater

The Trane Company, La Crosse, Wis. • East. Mfg. Div., Scranton Penn.
Trane Co. of Canada, Ltd., Toronto • 87 U. S. and 14 Canadian Offices

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING AND VENTILATING EQUIPMENT

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tools that Streamline electrical maintenance

FOR ELECTRONIC TROUBLE SHOOTING . . .

WESTON INDUSTRIAL CIRCUIT TESTER
(Model 785) the versatile 28 range supersensitive portable tester.

Especially designed for checking electronic control and power equipment. Seven d-c voltage ranges: .1 to 1000 (20,000 ohms per volt) . . . six a-c voltage ranges: 5 to 750 (1000 ohms per volt) . . . six d-c current ranges: 50 microamperes to 10 amperes . . . four a-c current ranges: .5 to 10 amperes . . . five resistance ranges: 3000 ohms to 30 megohms . . . all ranges full scale . . . a-c and d-c current ranges extended with external transformer or shunts.

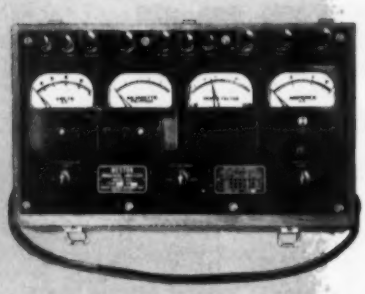
FOR MOTORIZED EQUIPMENT . . .

WESTON CLAMP VOLT-AMMETER
(Model 633) measures current and voltage without breaking circuits.

Combines in one instrument five full-scale a-c current ranges of 1000/250/-100/25/10 amperes with range overlap for good readability . . . three self-contained a-c voltage ranges of 700/350/-175 volts, with instrument insulated for 750 volt service. Has convenient 6-position thumb switch for range selection, and adjustable pointer stop for measuring motor starting current.

FOR POWER PROBLEMS . . .

WESTON A-C INDUSTRIAL ANALYZER
(Model 639) a combined Voltmeter, Wattmeter, Power Factor Meter, Ammeter . . . all interconnections made!



A real timesaver because only one hook-up is necessary to measure a-c current, voltage and power in single and polyphase circuits, as well as power factor in 3 phase, 3 wire, balanced circuits. Adequately insulated binding posts . . . high overload capacity. In compact oak case measuring only 18⅞" x 10⅞" x 6⅞".

AVAILABLE THROUGH LEADING DISTRIBUTORS

WESTON Instruments

WESTON Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark 5, N. J. 4815

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bulletins

(Continued from page 118)

492—Cast Steel Valves

Booklet 12-C, 56 pages, contains information on material specifications, preparation of welding ends, flange facings, and pressure-temperature ratings. Construction and specifications for globe, angle, and check valves in 300, 600, 900, and 1500 lb pressure classes are given. Also discussed are parabolic disk valves for hand or motor control of volume. Edward Valves, Inc.

493—Boiler Service Valves

Surface blow, bottom blow-off, water column blow-off, and connections are covered in 22-page bulletin E125, with complete specifications, materials, and dimensions of each type. Valve operation is explained by illustrations. Fire protection valves are included. Everlasting Valve Co.

WATER TREATMENT & WASTE DISPOSAL

494—Water Conditioning

Conditioning for boiler, process, and general applications is discussed in 20-page booklet 611A. A zeolite unit for manual and automatic operation is featured. In addition, chemical feed, zeolite-post treatment, zeolite-alkalinity neutralization, split-stream, and anion exchange dealkalization systems are explained. Elgin Softener Corp.

TO REQUEST FREE BULLETINS

Insert "key" numbers on Reply Card between pages 106 and 107. Your requests will be handled promptly.

495—Zeolite Softener

Bulletin 4520-A contains an explanation of zeolite water softening, data for laying out a softening plant, equipment size, selection of zeolites, and description of the operating stages of such softeners. A single control valve featuring 6 valves in one is also discussed. Cochrane Corp.

496—Water Softening

Bulletin WC-108, 12 pages, explains the distinction between the sodium and hydrogen cycle, and shows differences in results obtained by the two processes. Design and operation of zeolite equipment is described, and available methods for controlling various operations are discussed. A simple method of sizing such softeners and a table of recommended flow rates aids are given. Graver Water Conditioning Co.

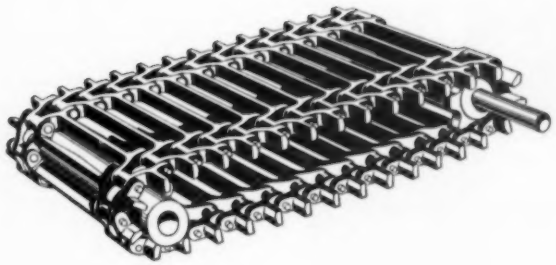
497—Ion Exchange

"Demineralization Including Silica Removal by Ion Exchange," 28-page booklet 3803, describes applications, principles of operation, design features, and advantages, and gives recommendations and specifications for demineralizing and silica removal apparatus and synthetic resins. The Permutit Co.

498—Amine Treatment

"Corrosion Protection of Steam and Condensate Return Systems," 4-page folder CP100, tells how amine treatment works to prevent corrosion. Advantages and disadvantages for this type of treatment are discussed. The Bird-Archer Co.

—*End*



The secret of no-clog feed for Perfect Spread

PERFECT SPREAD is the only STOKER available today that never clogs... not even on wet coal! And the secret of this remarkable efficiency is the exclusive American Engineering traveling conveyor feeder, pictured above, which employs a high traction principle and assures true, *continuous* feeding throughout its operating range of 50 to 7500 lbs. of coal per hour.

But in addition to no-clog feed, Perfect Spread Stoker gives you every other important feature... the special high-capacity spiral overthrow rotor which spreads coal over the whole grate so perfectly that it furnishes the stoker's name... the engineered cinder return and overfire air system that yield comparable results with both low and high ash coals.

Perfect Spread Stokers are made in a wide choice of sizes, capacities and grate types. Whether you are considering a new unit or restokering an old one, talk things over with your AE representative. It may lead to most steam at least cost.

AMERICAN ENGINEERING
COMPANY
2406 ARAMINGO AVE., PHILADELPHIA 25, PA.
IN CANADA: AFFILIATED ENGINEERING CORPORATIONS, LTD., MONTREAL 2, CANADA

AE Products are: Taylor and Perfect spread Stokers, Marine Deck Auxiliaries, Hele-Shaw and Hydromite Fluid Power, Lo-Hed Hoists, Lo-Hed Car Pullers.

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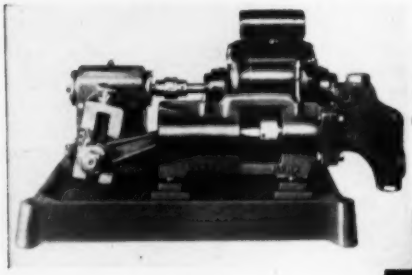
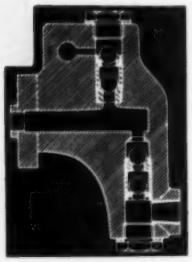
PICKED FOR PERFORMANCE--

ORCHEM

CHEMICAL PRESSURE PUMPS AND PACKAGE SYSTEMS



Featuring
EXCLUSIVE "INJECTO" VALVE



New ball and seat design of "Injecto" has two balls—two seats—in one complete unit. Low in cost — easily replaced.

Performance—plus practical features—make Orchem Pumps a logical choice for chemical pressure applications. Of proven basic design, they still offer features that give you unusual operating flexibility.

One of these is a choice of Manajust Stroke Adjustment—for varying capacity when pump is not operating—or Autajust—for precise control of flow *while pump is running*. Other optional features include Automatic Electronic Control Systems.

Also, you can select from a maximum of variable capacities—from 1 pint to 3,000 GPH—with pressures to 30,000 PSI.

PLUS CHOICE OF "AUTAJUST" OR "MANAJUST" STROKE CONTROL

ORCHEM PACKAGE SYSTEMS

To suit your application, Orchem Pumps are available in complete package systems, including welded steel tanks in standard sizes of 50, 100, 175, 250, and 500 gallons, complete with all accessories. Special combinations can be built to specifications.

Above—Autajust is variable while pump operates. See Manajust design on pump at top.

Picked for performance by many large firms, Orchem Pumps will give you excellent performance too. Write for Catalog.

ORCHEM PUMP DIVISION

4434 SALMON ST., PHILADELPHIA 37, PA.

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spot news

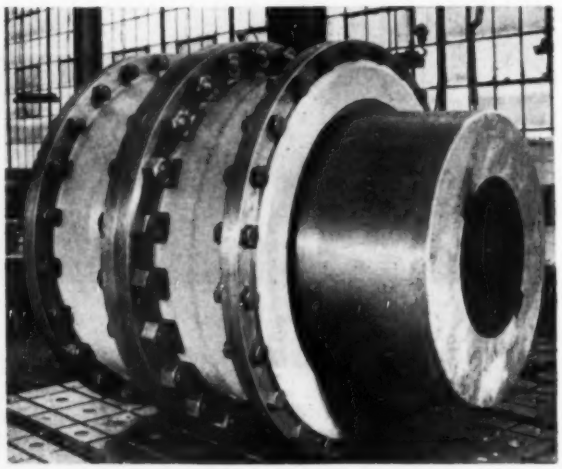
(Continued from page 104)

Caution Urged in Use of Corrosion Control Devices

Serious damage to expensive equipment may result from the use of certain unproved devices for controlling corrosion and scaling according to the Inter Society Corrosion Committee. The committee, made up of some 35 delegates from technical societies in the United States and Canada, is sponsored by the National Association of Corrosion Engineers.

Caution is urged in the application of methods which are not based on any understandable scientific principle and which are promoted on the basis of testimonials from presumably satisfied customers, unsupported by quantitative data. Special attention is drawn to supposedly scientific explanations making liberal and incoherent use of terms such as catalysis, magnetism, electronics, and radiation.

In some cases recommendations are made by manufacturers that grounding wires of electrical circuits, if unfavorably connected to pipes in which the devices are installed, should be rearranged or connected elsewhere. The committee emphasizes that if electrical circuits are not grounded in accordance with the National Electrical Code, serious impairment of the safety of persons and property may result.



Self-Aligning Coupling Built for Italian Plate Mill

Custom-built, this huge self-aligning coupling required 6 months to machine and assemble. Made by Fast's Coupling Dept. of Koppers Co., it is being shipped to Milano, Italy where it will carry power to a Mesta 110 in., 4-high reversing plate mill.

The largest such unit ever built, it can transmit up to 62,000 hp in straight-line as compared to 50.000 hp for couplings previously manufactured. Some idea of the size is shown by the fact that the motor hub had to be machined to fit a 32½ in. dia shaft.

(Continued on page 124)

GENERAL
REG. U.S. PAT. OFF.

RODA — High grade gas, by-product, steam and household stoker coal from Wise County, Virginia, on the Interstate Railroad.

DENDRON — High grade gas, by-product, steam and domestic coal from Wise County, Va., on the Interstate Railroad.

STONEGA — High grade, high volatile steam and by-product coal from Wise County, Va., on the Interstate Railroad.

GLENBROOK — The Premium Kentucky High Splint unmatched for domestic use. Produced in Harlan County, Kentucky, on the L. & N. Railroad.

COKE — Roda and Stonega from Wise County, Va.

CRITERION COAL — High grade gas, by-product, steam and domestic coal—Pittsburgh seam from Irwin Basin, Westmoreland County, Pennsylvania, on the Penna. Railroad.

HAMPTON COAL — High volatile domestic, steam and by-product coal from Boone and Logan Counties, W. Va., on the Chesapeake & Ohio Ry.

CROZER — Genuine Pocahontas from McDowell County, W. Va., on the Norfolk & Western Railway.

LYNCO — High fusion coking coal for by-product, industrial stoker and pulverizer use from Wyoming Co., W. Va., on the Virginian Ry.

ANTHRACITE

Hazel Brook—*Premium Lehigh*
Raven Run—*Premium Mahanoy*
Cross Creek—*First Grade Lehigh*

Our engineering service, available upon application, and long and varied experience is your assurance of the Right Coal — Properly Applied.

General Coal Company

123 SOUTH BROAD STREET PHILADELPHIA 9, PA.

CABLE ADDRESS, GENCO

Branches:

BLUEFIELD, W. VA. BUFFALO CHARLOTTE, N. C. CINCINNATI
CLEVELAND IRWIN, PA. NEW YORK NORFOLK

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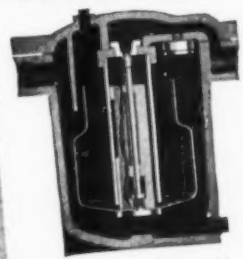
ILLINOIS Steam Trap



Simple—has only two moving parts

Valve Stem Travels Independent of Bucket—no other trap has this feature.

Instantaneous Valve Action — either wide open or tight shut — will not dribble on partial closing of valve under slow condensation rates.

Wire Drawing Impossible — valve has snap action.

Simple — moving parts are valve and bucket.

Cannot Air Bind — vents air continuously without loss of steam.

Cannot Blow Steam — always water sealed.

Surface Discharge—flushes out all grease and sludge.

Valve Seat — of special alloy, fully guaranteed.

Inspection Easy — without disturbing piping.

Works Equally Well on All Fluids — compressed air lines, air separators, air aftercoolers.

Write for Bulletin 35

Consult us on your requirements

ILLINOIS ENGINEERING COMPANY
INCORPORATED 1905
RACINE AVENUE AT 21ST STREET • CHICAGO 8

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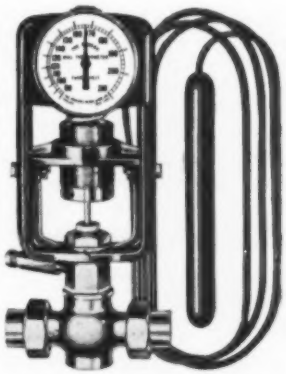
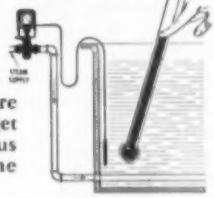


NEW POWERS REGULATOR

For
Plating • Anodizing
Bonderizing • Pickling
Cleaning • Rinsing

Holds temperature where you want it.



Saves LABOR and Steam
Helps Eliminate Costly Rejects

Powers No. 11-MF Regulators are self-operating. They will help you get the most effective use from various solutions by holding them at the right temperature automatically.

Plastic Covered Thermal Bulb and Tubing—is highly resistant to solutions in above processes. Prevents electrical shorts. No insulators required for the regulator.

Easy to Read 4" Dial Thermometer—indicates temperature of liquid being controlled and makes it easy to adjust regulator for different temperatures.

Bulletin 330 describes this simple, dependable control. May we send you a copy? (b31)

THE POWERS REGULATOR CO., SKOKIE, ILL.
Offices in over 50 Cities, see your Phone Book • Established in 1891

Circle 579 on Reply Card for more data

USE STRONG* STRAINERS -for *better* protection!

For steam, air, water and gas. STRONG'S new "Y" type strainer is ideal for the protection of steam traps, reducing valves, temperature controls, air control equipment, pumps, etc.

A HIGH-QUALITY, LOW-COST STRAINER!

★ **Monel Screen**—Mesh cloth in sizes ¼" to ⅜", larger sizes standard with .027 perforations. Self-centering guides prevent crushing.

★ **Semi-steel Body**—For rugged service. Sizes ¼" to 3". For steam pressures to 250 psi, cold pressures to 400 psi.

★ **Easy Installation**—New V-shaped gripping lugs on inlet and outlet bosses—may be easily installed with any type wrench.

CAST STEEL "Y" STRAINER

Available for pressures to 600 psi, screwed and flanged. Sizes ¼" to 4".
Send for Catalog 68-S today!

*Reg. Trade Mark

STRONG, CARLISLE & HAMMOND COMPANY
1392 West 3rd Street
Cleveland 13, Ohio

ANUM METL Reg. Trade Mark

OTHER STRONG STEAM SPECIALTIES

No. 070 Small Trap

80 Series Trap

"T" Type Strainer

STRONG

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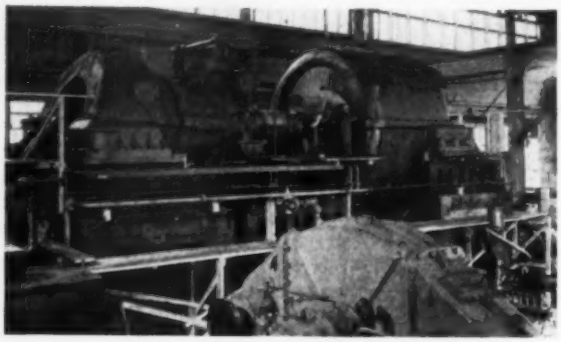
spot news

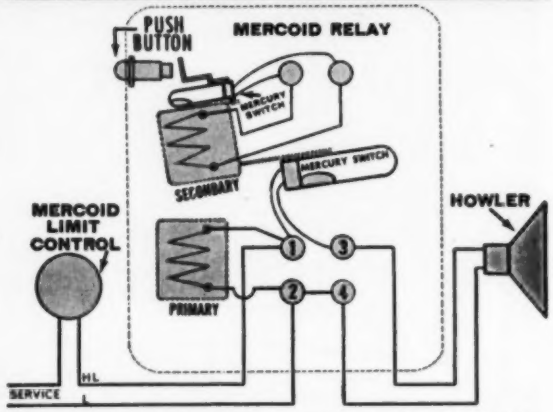
(Continued from page 122)



Large Turbo-Blower Installed at Armco

One of the largest turbo-blowers built in this country is shown installed at Armco Steel Corporation. With a rated capacity to deliver 121,000 cfm of air at 35 lbs psig discharge pressure, it is one of a pair built by De Laval Steam Turbine Co., and will be driven by a 15,200 hp, 2500 rpm, 16-stage steam turbine under operating conditions of 400 lbs psi, 750 F with 28 in. vacuum.

MERCOID RELAY FOR AUDIBLE ALARM



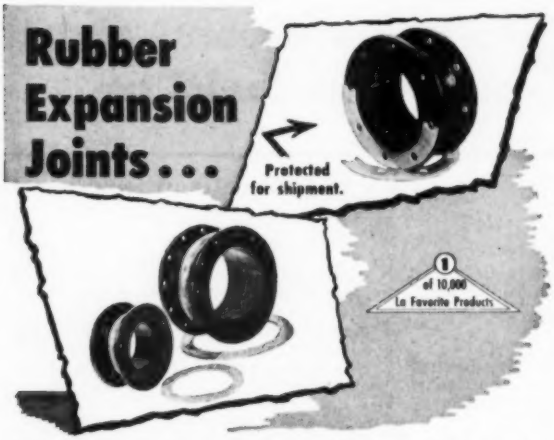
When Limit Control closes its circuit, current is supplied to primary coil of Mercoid Relay and through the normally closed mercury switch to the "Howler" (alarm). To stop "Howler," operator pushes in "push button" which manually raises relay secondary and breaks circuit to "Howler." Secondary is held up by magnetic repulsion until condition is corrected. When limit control opens the primary circuit of relay, secondary coil drops to normal position and relay is automatically ready for another operation.

WRITE FOR BULLETIN CA-8R

THE MERCOID CORPORATION 4201 BELMONT AVE., CHICAGO, ILL.

Circle 609 on Reply Card for more data

Rubber Expansion Joints . . .



Rubber Expansion Joints shown are just a few of the many furnished to a public utility, but adaptable to any pipeline installation for transporting liquids or gases where the temperature does not exceed the range of –10°F. to 200°F. For other temperature conditions, consult our engineers.

With a backlog of more than half a century of experience, La Favorite "know-how" is daily solving many complex problems which involve protection from corrosion and abrasion. Consult La Favorite Engineers, without obligation on your part.

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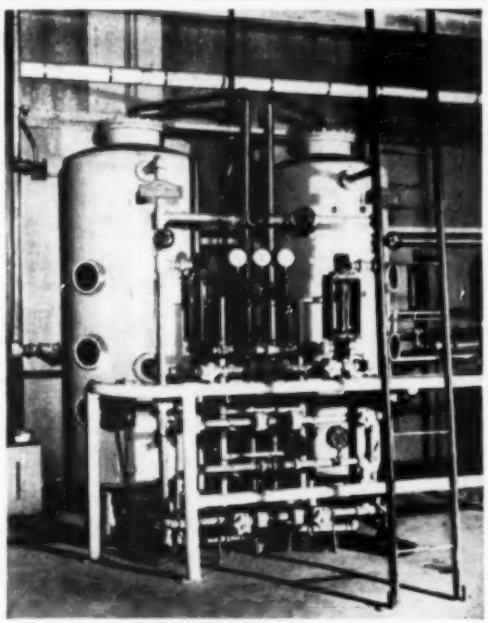

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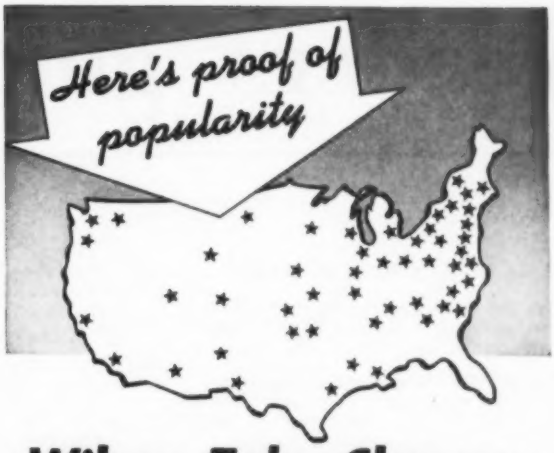

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readers' guide

. . . to advertised products

AIR FILTERS & DUST COLLECTORS

Key No. 586—Engineered efficiency in dust collection. Bulletin 'LR'. Buell Engineering Co. p 128.

Key No. 533—Multiclone Collectors offer many advantages in fly ash recovery. Free booklet. Western Precipitation Corp. p 46.

Key No. 537—Assembled in complete Unibloc sections, Prat-Daniel collectors require less time for erection in the field. P-D catalog 4P201. Prat-Daniel Corp. p 50.

BOILERS & BOILER ACCESSORIES

Key No. 534—Beacon Coal's wide range of sizes prepared on modern screening equipment. Eastern Gas & Fuel Associates. p 47.

Key No. 577—Engineering service and varied experience assures the right coal. General Coal Co. p 123.

Key No. 557—Stowe Stokers said to eliminate smoke and fly ash nuisance. Bulletin 501. The Johnston & Jennings Co. p 101.

Key No. 526—VP Boilers have capacities from 4000 to 30,000 lb of steam per hr. Bulletin VP-131. Combustion Engineering, Inc. p 39.

Key No. 556—Bell & Zoller's coals keep boiler efficiency up . . . steam costs down. Bell & Zoller Coal Co. p 100.

Key No. 560—Petro oil burners slash fuel costs. Catalog. Petro Div. p 105.

Key No. 607—Wickes boilers are adaptable to any standard method of firing. Literature available. The Wickes Boiler Co. p 139.

Key No. 552—Be sure of plenty of fuel at relatively stable prices, with bituminous coal. Literature available. Bituminous Coal Institute. p 65.

Key No. 530—High efficiency with low maintenance. Free catalog. Detroit Stoker Co. p 43.

Key No. 566—Boilers of unusual economy and dependability. Kewanee-Ross Corp. p 112.

Key No. 517—Investigate Riley equipment when considering new steam generating or fuel burning equipment. Riley Stoker Corp. pp 28-29.

Key No. 539—DeLaval boiler feed pumps are not affected by sudden temperature changes. DeLaval Steam Turbine Co. p 52.

Key No. 558—With the Continental, you get a self-contained, automatic steam generator. Boiler Engineering and Supply Co., Inc. p 103.

Key No. 544—Worthington is prepared to furnish boiler feed pumps for any modern power plant requirements. Worthington Corp., Centrifugal Pump Division p 57.

Key No. 521—Enco gas-oil burners will burn oil or gas—or both. The Engineer Co. p 33.

Key No. 531—EconoTHERM gives quick steam with greater safety. Bulletin EC-52 B. Dutton Boilers. p 44.

Key No. 575—Perfect Spread Stoker assures no-clog feeding with an operating range of 50 to 7500 lbs of coal per hr. American Engineering Co. p 121.

Key No. 565—Heacon dampers are designed and constructed to meet practically any pressure or temperature specs. The Thermix Corp. p 111.

Key No. 511—Beaumont hydraulic ash handling systems give long service with a minimum of maintenance. Beaumont Birch Co. p 20.

Key No. 595—National pneumatic steam ash removal systems add to the efficiency of your plant. National Conveyors Co., Inc. p 134.

Key No. 584—G-W automatic coal handling systems are engineered for efficiency. Gifford-Wood Co. p 127.

Key No. 561—Superior Steam Generators in 18 sizes for pressures to 250 psi or for hot water. Catalog 502. Superior Combustion Industries Inc. p 106.

Key No. 563—For process steam, heating, or "on-the-spot" construction steam, the FW Package Steam Generators produce all-around savings. Foster-Wheeler Corp. p 109.

(Continued on page 128)

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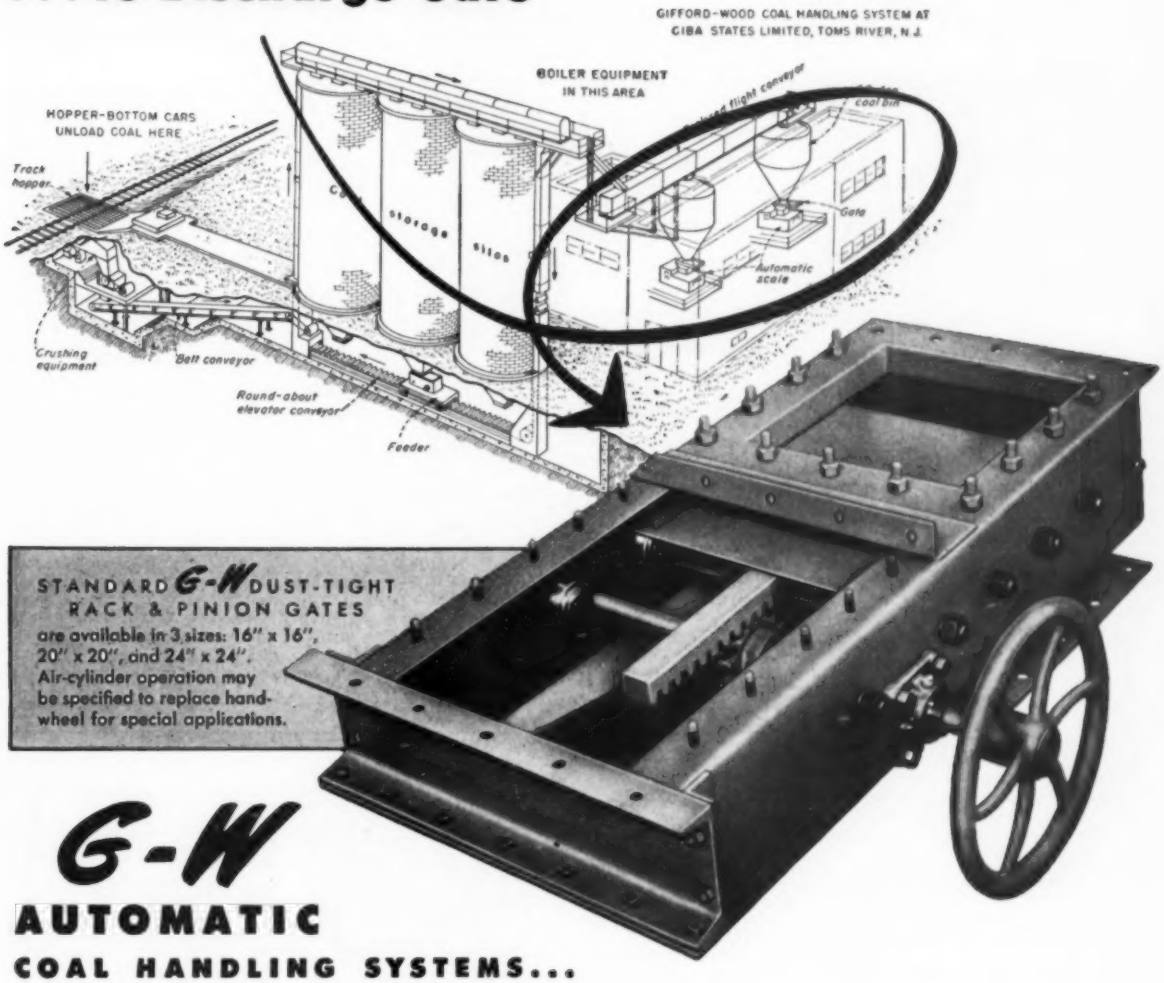
NOTE—This department is both a product index for advertising and a keyed listing for advertised literature. Refer to advertisement on page indicated and contact advertiser directly —or list key numbers on Reply Card (page 34 - 35 & 106 - 107) to get data you want

from Receiving Grate ... to Discharge Gate


GIFFORD-WOOD COAL HANDLING SYSTEM AT CIBA STATES LIMITED, TOMS RIVER, N.J.
BOILER EQUIPMENT IN THIS AREA
HOPPER-BOTTOM CARS UNLOAD COAL HERE
Track hopper
storage silos
coal bin
Gate
automatic scale
Crushing equipment
Belt conveyor
Round-about elevator conveyor
Feeder
STANDARD G-W DUST-TIGHT RACK & PINION GATES
are available in 3 sizes: 16" x 16", 20" x 20", and 24" x 24". Air-cylinder operation may be specified to replace hand-wheel for special applications.

G-W AUTOMATIC COAL HANDLING SYSTEMS...

engineered for efficiency

This Rack and Pinion Gate is typical of G-W attention to engineering detail. It's the last piece of equipment in the complete G-W Automatic Coal Handling System in the huge new plant of Ciba States Limited, Toms River, N. J.

Through two of these gates pass all the coal used by this large processing plant. They absorb tons of pressure—day in, day out. Yet the rugged all-welded construction of the gate housing gives complete protection to all parts and traps all coal dust. Turning the handwheel moves the slide plate over sturdy roller bearings through a simple rack and pinion mechanism. Simple design?—Yes ... but the very efficiency of this gate lies in its *engineered* simplicity ... the Gifford-Wood way.

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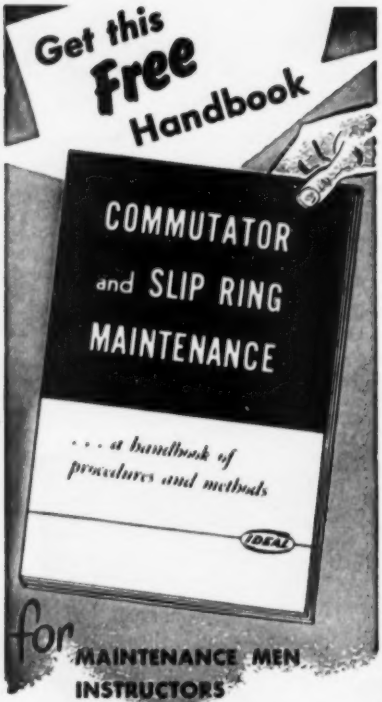

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in Motor Maintenance

THE methods and procedures described were developed by recognized, practicing maintenance authorities. They have been proven by conclusive evidence over many years in hundreds of operations. A concise guide, this 39-page handbook tells the practical operating man everything he needs to know about:

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readers' guide

(Continued from page 126)

Key No. 535—Gas fired package unit steam generators with 25,000 pounds steam per hr capacity. Bulletins available. Henry Vogt Machine Co. p 48.

Key No. 515—Bulletin 2000 contains complete details on unit steam generator. Preferred Utilities Mfg. Corp. p 26.

DIESELS & GAS ENGINES

Key No. 505—Cooper-Bessemer compressors give top performance at low operating cost. The Cooper-Bessemer Corp. p 9.

ELECTRICAL EQUIPMENT

Key No. 518—Heinemann Circuit Breakers prevent motor burnouts. Bulletin 1410. Heinemann Electric Co. p 30.

Key No. 542—Catalog 50 presents information and data on many of the Chromalox Electric Heating Units. Edwin L. Wiegand Co. p 55.

Key No. 516—Bulletin GEA-5810 gives complete information on G-E Weather-protected motors. General Electric Co. p 27.

Key No. 514—I-T-E offers a complete line of unit substation equipment. I-T-E Circuit Breaker Co. pp 24-25.

Key No. 527—When power fluctuations affect processes, Sorensen AC line regulators save money. Sorensen and Co. p 40.

Key No. 574—Tools that streamline electrical maintenance. Weston Instruments. p 120.

Key No. 585—Complete methods and procedures of motor maintenance. Free handbook. Ideal Industries, Inc. p 128.

Key No. 545—G-E White conduit is easier to bend because the "metallizing" process eliminates quenching and straightening that cause hardening. General Electric Co. p 58.

BUILDING MATERIALS & MAINTENANCE

Key No. 600—Cover dangerous open areas and add useful space with Open Steel Flooring. Coupon for details and prices. Blaw-Knox Co. p 135.

Key No. 601—Smooth-On No. 1 Iron Cement does not require use of heat or gadgets. Free handbook. Smooth-On Mfg. Co. p 137.

Key No. 606—Instant setting concrete patch bonds tight to old concrete. Free handbook. Flexrock Co. p 138.

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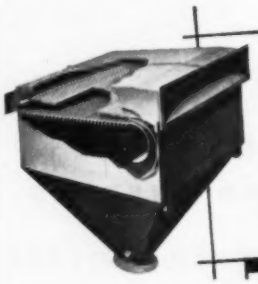

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BUELL MECHANICAL CYCLONE SYSTEM

Buell 'LR' Collector gets 99% of all 100-mesh and larger cinder discharge. Top efficiency for boilers from 100 to 2000 BHP.

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DUST COLLECTION

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INSTRUMENTS & CONTROLS

Key No. 602—Tank gage for gaging liquids of all kinds. The Liquidometer Corp. p 137.

Key No. 523—Model 1000 is the latest addition to the Auto-Lite line of temperature recorders & indicators. The Electric Auto-Lite Co. p 35.

Key No. 551—Steam leaks due to lack of absolutely tight shutoff are eliminated in Spence Temperature Regulators. Bulletin T50. Spence Engineering Co., Inc. p 64.

Key No. 594—Jerguson Truscales give instant remote readings of liquid levels of boilers, deaerating tanks, etc. Jerguson Gage & Valve Co. p 133.

Key No. 579—No. 11-MF regulators hold temperature where you want it. The Powers Regulator Co. p 123.

Key No. 609 — Bull CA-8R describes Mercoid relay for audible alarm. The Mercoid Corp. p 124.

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ENGINES & TURBINES

Key No. 522— Bull S-116 describes advantages of the Terry solid-wheel turbine. Bull S-146 gives details on multistage turbines. The Terry Steam Turbine Co. p 34.

Key No. 520—Simplified design and rugged construction assure long life and reliability of Murray turbines. Murray Iron Works Co. p 32.

Key No. 508—Elliott turbines can be adapted to practically any operating condition or service. Bulletins available. Elliott Co., Steam Turbine Dept. pp 14-15.

FANS & BLOWERS

Key No. 512—Coppus Ventilators are used in wide variety of applications throughout industry. Coupon on p 21. Coppus Engineering Corp.

Key No. 500—If inadequate ventilation clouds your production picture, Hartzell specialists can help. Bulletins available. Hartzell Propeller Fan Co. p 2.

FILTERS, STRAINERS, & PURIFIERS

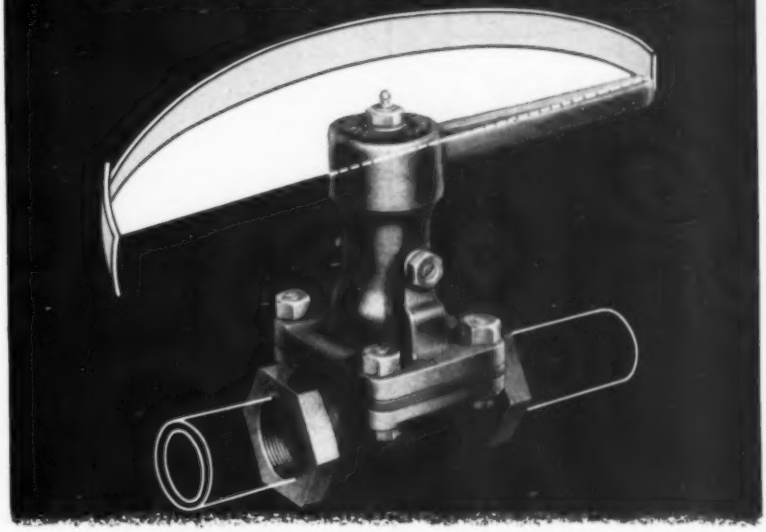
Key No. 580—Strong's new "Y" type strainer for the protection of steam traps, reducing valves, etc. Catalog 68-S. Strong, Carlisle & Hammond Co. p 124.

Key No. 604—A pipe strainer keeps harmful rust and scale from equipment and control accessories. Bulletin available. Armstrong Machine Works. p 137.

(Continued on page 130)

with this corrosion resistant valve . . .

YOU GO FROM FULL OPEN TO FULL CLOSED IN A 180° SWING OF THE LEVER



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Quick Opening

SAUNDERS PATENT DIAPHRAGM VALVES

Where you must combine the ability to handle tough services with quick opening—quick closing characteristics, Hills-McCanna Lever operated Diaphragm Valves are the answer. The lever action is smooth and positive. An adjustment for holding the handle in an intermediate position provides throttling when required. Available with choice of fifteen diaghragm materials including rubber, neoprene, polyethylene, Kel-F and Teflon. Choice of over fifty body materials that include rubber, glass, lead, and plastic linings, any machinable alloy and plastics. Dependent upon materials and size, Hills-McCanna Saunders Patent Valves are suitable for temperatures to 400°F., pressures to 150 psi. Write for descriptive literature. HILLS-McCANNA CO., 2355 W. Nelson St., Chicago 18, Illinois.

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saunders patent diaphragm valves

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Force Feed Lubricators Magnesium Alloy Sand Castings

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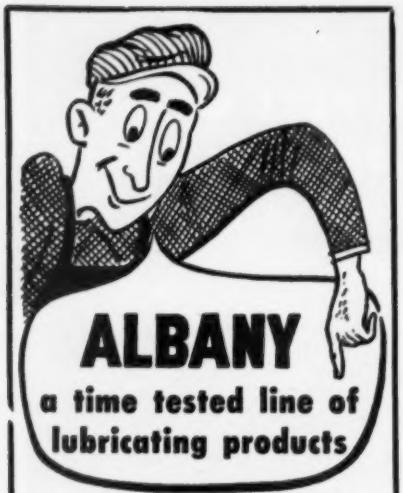

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ALBANY LUBRICANTS

ALBANY PRESSUREGREASE UNIVERSAL
For Cups — Ball Bearings — Water Pumps — Universal Joints. Waterproof — Exceptionally high melting point. Soft enough for gun application.

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A cooling lubricant for operating temperatures from 110° F to 200° F.

ALBANY PRESSUREGREASE
A superior waterproof mineral oil grease of high viscosity. Comes in Liquid, Soft, Medium, Hard and Graphite Pressuregrease Soft and Medium.

ALBANY BEARING LUBRICANT
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Will not separate or oxidize assuring long life to bearings. May be used in hand grease guns.

ALBANY GEAR LUBRICANTS
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Quick-acting. Cuts rust as well as lubricates. Loosens sticky valves, eliminates squeaks.

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Your Supply House Has These Items in Stock

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ADAM COOK'S SONS, Inc.
Mfrs. of Albany Lubricating Products
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readers' guide

(Continued from page 129)

Key No. 590—Elliott Twin Strainers are used in practically every industry where liquids are involved. Bulletin A-13. Elliott Co., Accessories Dept. p 131.

HEAT EXCHANGER EQUIPMENT

Key No. 569—When there is a large & constant demand for hot process water, P-K can recommend the proper recovery system. Cat. No. 310. The Patterson-Kelley Co., Inc. p 115.

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HEATING, AIR CONDITIONING & REFRIGERATION

Key No. 546—Air heaters, individually fabricated to meet specifications, available as horizontal or vertical units. John Zink Co. p 59.

Key No. 573—Spot heat where you need it with Trane unit heaters. Bulletin DS-327B. Trane Co. p 119.

LUBRICANTS & LUBRICATION EQUIPMENT

Key No. 588—Your supply house has the Albany time-tested line of lubricating products in stock. Adam Cook's Sons. p 130.

Key No. 540—Shell Alvania Grease replaces many special purpose greases. Shell Oil Co. p 53.

Key No. 503—Hilco offers a wide range of oil purification units. Literature available. The Hilliard Corp. p 6.

Key No. 554—Sunep coats surfaces with a chemically bonded film which is virtually unbreakable. Sun Oil Co. p 95.

Key No. 502—Standard HD oil gives outstanding performance. Standard Oil Company (Indiana). p 4.

Key No. 550—Rubilenes can improve the efficiency of your diesel engines. Sinclair Refining Co. p 63.

Key No. 596—For the solution to lubrication difficulties, more and more companies are turning to Manzel force feed lubrication. Manzel. p 134.

IN W. S. Rockwell Butterfly Valves *you're sure to get*

AUTOMATIC CONTROL

for quick opening and shut-off by motor, air operator, air or hydraulic cylinder or positioning for any desired flow rate.

RESISTANT CONSTRUCTION

of cast iron and steel, stainless steel, bronze, Hastelloy, or rubber-lined to withstand chemical or abrasive action.

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of air, gases, liquids and semi-solids at temperatures below freezing or as high as 2000° F., at pressures to 300 p.s.i.g. without clogging or breakdown. You can be sure—if you install Rockwell Butterfly Valves. Pipe sizes 1" to 4" threaded; 4" to 120" flanged or wafer types.

Write for Catalog and the "Valve News"

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ROCKWELL SINCE 1888 BUILT

BUTTERFLY VALVES • SLIDE VALVES • AUTOMATIC VALVES

2303 ELIOT STREET • FAIRFIELD, CONN.

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Key No. 592—Non-Fluid oil meets the most exacting standards of bearing engineers. Bulletin 506A. New York & New Jersey Lubricant Co. p 132.

MATERIALS OF CONSTRUCTION

Key No. 549—Monel is a solid solution alloy with twice the strength of brass and equal to structural steel. The International Nickel Co., Inc. p 62.

MECHANICAL POWER TRANSMISSION

Key No. 593—Lovejoy flexible couplings increase operational efficiency. Catalog & Selector charts. Lovejoy Flexible Coupling Co. p 133.

Key No. 603—Positive positioning of every Hallowell Collar is assured by the self-locking Unbrako socket set screw. Literature available. Standard Pressed Steel Co. p 137.

Key No. 555—Gates V-belts are built with concave sides... that's why they last longer. The Gates Rubber Co. p 96.

Key No. 506—A new barrel bearing is available in volume for the first time. Hyatt Bearings Div. pp 10-11.

Key No. 501—Goodyear distributors can supply hose, belting and other industrial rubber products. Goodyear Tire & Rubber Co. p 3.

Key No. 547—Lower V-belt drive costs. Raybestos-Manhattan, Inc., Manhattan Rubber Div. p 60.

PACKINGS & GASKETS

Key No. 570—Pumcups operate at full efficiency throughout their entire life. Bulletins No. 4502 & 4401. Darling Valve & Mfg. Co. p 116.

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Key No. 548—R/M's "Big 7" packing types cover 95% of all packing needs. Raybestos-Manhattan, Inc. p 61.

PIPE, TUBING & HOSE

Key No. 564—Dart unions are leakproof because they are precision-machined to a true ball joint. Dart Union Co. p 110.

Key No. 599—Key graphite paste for sealing oil and high pressure steam lines. Key Co. p 135.

Key No. 567—Flexon expansion joints provide leakproof, maintenance-free pipeline motion control. Flexonics Corp. p 113.

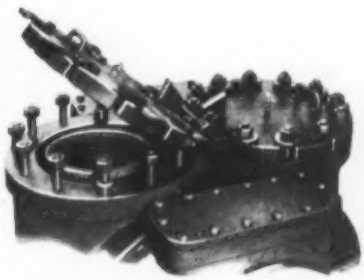
(Continued on page 132)

Big baskets mean fewer clean-outs

● Each basket gives a ratio of straining area to inlet area of 5 to 1, affording a reserve capacity for arrested debris that permits of long operating periods without dumping. Even then the clean-out need not be immediate as the alternate basket will take up the straining load at the turn of a couple of valve handles. Note that the top of the basket is open, greatly facilitating dumping. When in the straining chamber, the basket drops just far enough, on a set-screw adjustment, to permit the strainer top to effectually close the basket top opening.

DOORS ARE OF HEAVY STEEL PLATE, crack-proof even under most unusual stress. No need to worry when turning down the holding nuts to insure uniform stress all around. The nuts are never removed from the studs as backing them off a turn or two relieves tension on the "S" shaped washers, which can then be slipped aside to permit raising of the door.

Elliott Twin Strainers are used in practically every industry where liquids are involved. Types for high and low pressure. Sizes 4 in. to 24 in. Bulletin A-13 has complete data. Ask your local Elliott representative or write Elliott Company, Jeannette, Pa.



ELLIOTT Company

Accessories Dept.

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A3-1

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SOLENOID
VALVES

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- VISIBLE ACTION

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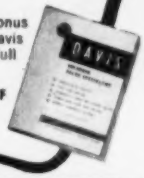

Davis
DAVIS REGULATOR COMPANY
2509 So. Washtenaw • Chicago 8, Illinois
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readers' guide

(Continued from page 131))

Key No. 581—Rubber expansion joints are adaptable to any pipeline installation for transporting liquids or gases. LaFavorite Rubber Mfg. Co. p 125.

TOOLS

Key No. 529—"There's an Airetool Tube Cleaner or Expander for every type of tubular construction." Bulletin shows types & sizes. Airetool Mfg. Co. p 42.

Key No. 568—Electric impact wrench cuts nut-running time 75%. Catalog available. Snap-on Tools Corp. p 114.

Key No. 583—Wilson tube cleaners handle every kind of deposit, making quick work of cleaning straight or curved tubes. Bulletin available. Thomas C. Wilson, Inc. p 125.

PROTECTIVE COATINGS

Key No. 538—Rust-Oleum, applied by brush, dip, or spray, stops rust. Literature offered. Rust-Oleum Corp. p 51.

PUMPS & COMPRESSORS

Key No. 597—Get acquainted with Aurora centrifugal & APCO turbine-type pumps. Catalog "M". Aurora Pump Co. p 135.

Key No. 559—Weinman centrifugal pump specialists know how to reduce pumping costs. The Weinman Pump Mfg. Co. p 104.

Key No. 543—Find out why Worthington's vertical turbine pump is the choice of food, chemical & industrial firms. Bulletin W-450-B39. Worthington Corp. p 56.

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Key No. 598—Sims Pump Valves, for all reciprocating pumps, are stocked for quick delivery. Bulletin IP-1. Sims Pump Valve Co., Inc. p 135.

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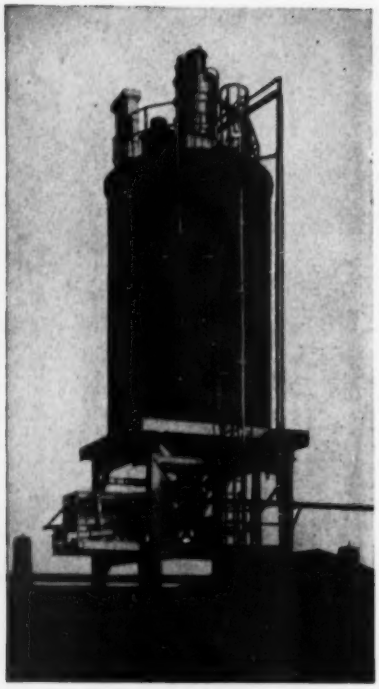

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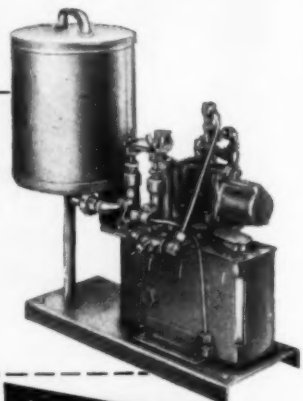

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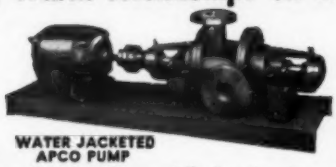

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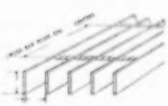

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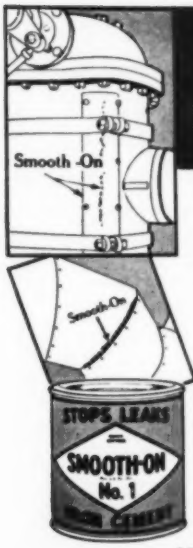

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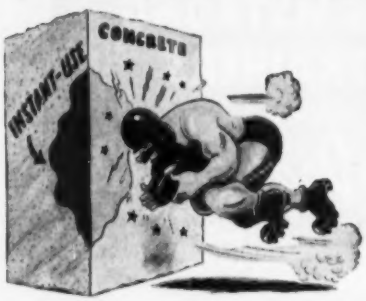

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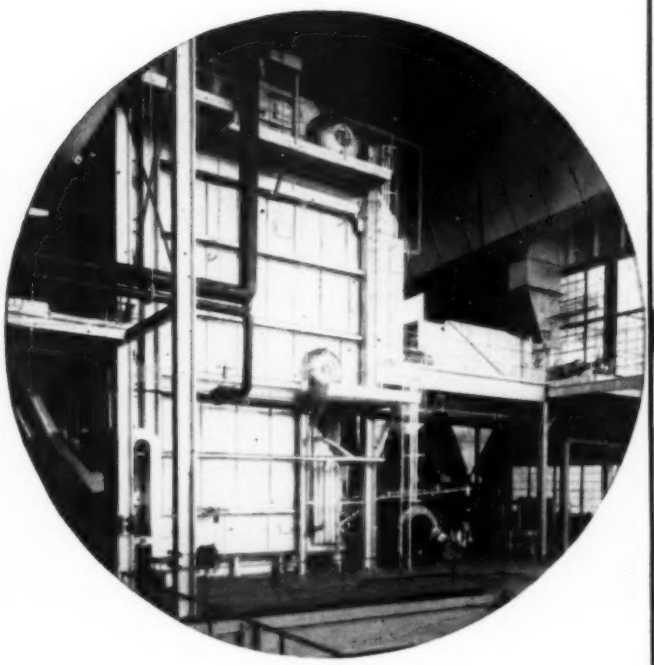

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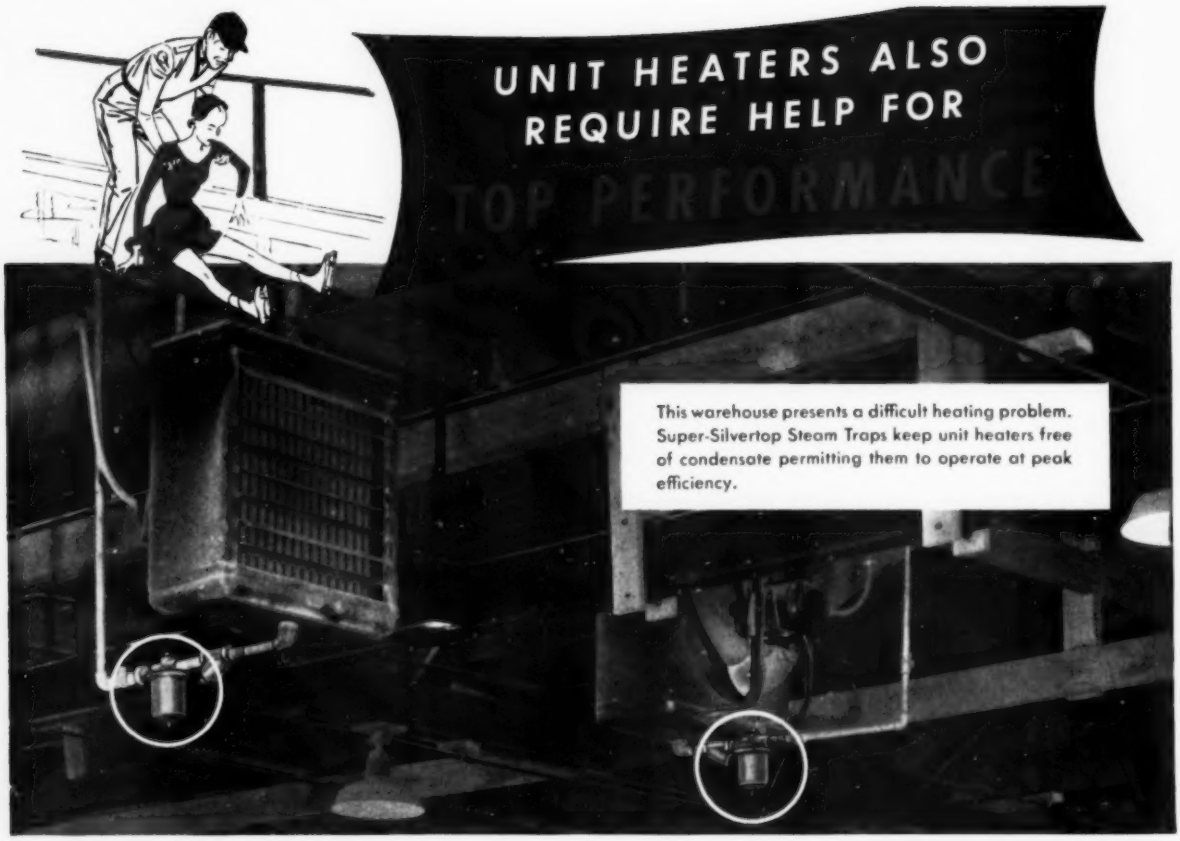
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